JUNE • 1946

TOOL & DIE JOURNAL

DESIGN, MANUFACTURE AND USE OF PRODUCTION TOOLING

Ability TO PRODUCE

Here are views showing some of the equipment used for producing Putnam Hi-Speed End Mills.

Better END MILLS

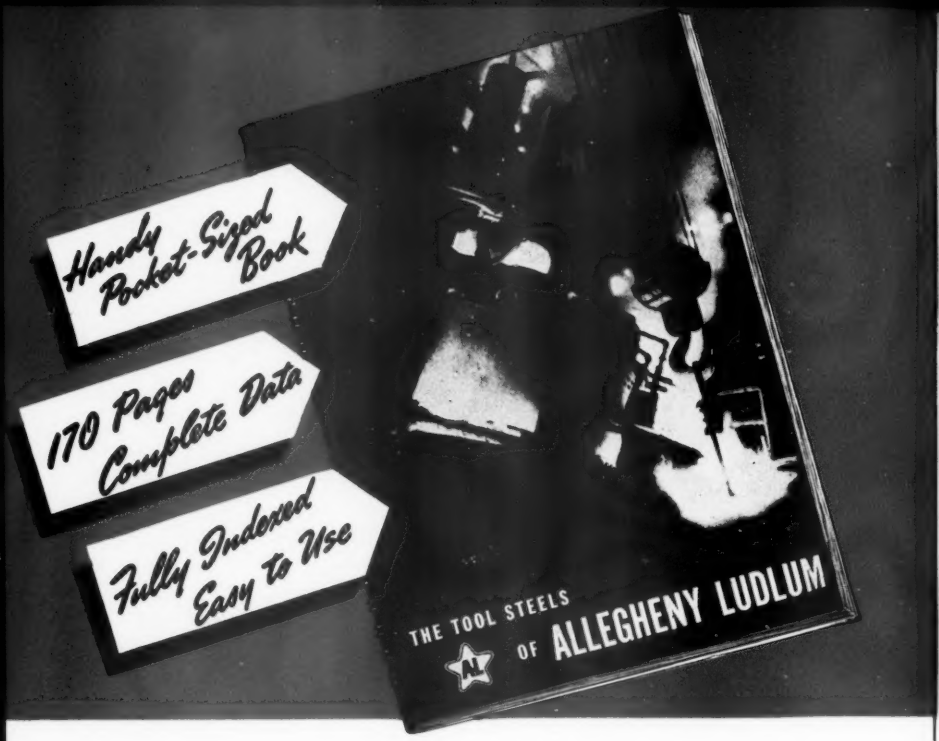
Putnam's primary interest has always been the manufacture of end mills. Every plant expansion . . . every addition to personnel . . . and every purchase of new equipment has principally been for the purpose of producing better end mills in more widely varied types and sizes.

Today, it is an accepted fact that Putnam has unexcelled facilities and the experienced organization required to produce the finest end mills. Putnam, too, offers the world's most complete line of these tools—with every type of end mill immediately available from factory or distributor stocks.

When you require any end mill, get the advantages of *specialized* production. Specify "Putnam".

PUTNAM TOOL CO.

2985 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN



THE ANSWERS TO ALL YOUR NEEDS IN

TOOL AND DIE STEELS . . .

- ★ HIGH SPEED STEELS
- ★ HOT WORK STEELS
- ★ SHOCK RESISTING STEELS
- ★ COLD WORK STEELS
- ★ CARBON STEELS
- ★ HIGH SPEED AND TOOL STEEL FORGINGS
- ★ CAST-TO-SHAPE TOOL STEELS
- ★ COMPOSITE DIE STEELS

TO MEET ANY REQUIREMENTS

TODAY—and for a long time to come—the premium on production cost-saving is greater than ever before. Match up each one of your machine operations with the tool or die steel that will do the job faster, better, or with less "down" time. This new booklet gives you complete information on the exceptionally large family of Allegheny Ludlum Tool Steels—invaluable data on properties, uses, selection and handling that every production man should have.

write for your copy **Address Dept. TD-49**

ALLEGHENY LUDLUM

STEEL CORPORATION · Pittsburgh 22, Pa.

Pioneer in Specialloy Steels

AIR POWERED

HYDRAULICALLY CHECKED

ELECTRICALLY CONTROLLED

This NEW Bellows-Senacon DRILL PRESS FEED

WILL DO EVERYTHING BUT DRAW A PAY CHECK!

Answer to today's problem of *extra* production from each cost dollar, Bellows-Senacon DFE Drill Press Feeds will substantially increase production on drill press operations: drilling, tapping, reaming, fly-cutting, or others.*

This new electrically controlled feed makes possible such operations as continuous cycling, dwell control ranging from 2/10ths of a second to 180 seconds, automatic drill cleaning, or deep hole drilling, and operations of one, two or more feeds synchronized with a single work holding fixture.

** Designed primarily for Drill Press operation. Bellows-Senacon Feeds are readily adaptable to Milling Machines, Threaders, Grinding Machines, etc.*

Model "DFE" Feeds are built with simple, positive, readily adjustable controls to make possible correct feeding rates, power thrusts, etc., for virtually any tool, working in virtually any stock. Independent speed controls permit infinite variation of feed and traverse rates. Feeding thrust can be varied to any desired degree. The Bellows Hydro-Check, an adjustable hydraulic resistance unit (optional equipment) assures utmost smoothness of feed, permits checking the feed at the point of breakthrough or at any other predetermined point. Three models with stroke lengths permitting one and one-half, one, or one-third revolutions of the drill press shaft.

Write Today . . .

Write today for Bulletin DF-102 and the full story how you can boost drill press production 40% to 500%

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SENACON DIVISION
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Tool & Die Journal is published monthly for those industry key men who constitute, in each plant, the Cycle of Buying Influence—CBI—and who are responsible for the design, manufacture and use of production tooling.

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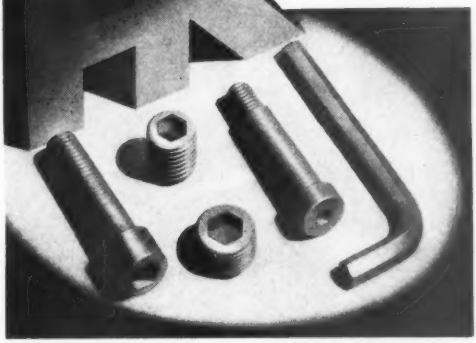
THE BETTER FASTENING METHOD

Completely

COLD FORGED



CAP — SET — PIPE PLUG — STRIPPER BOLT — KEY

Savers of

WEIGHT-SPACE
ASSEMBLY TIME

HOLO-KROME

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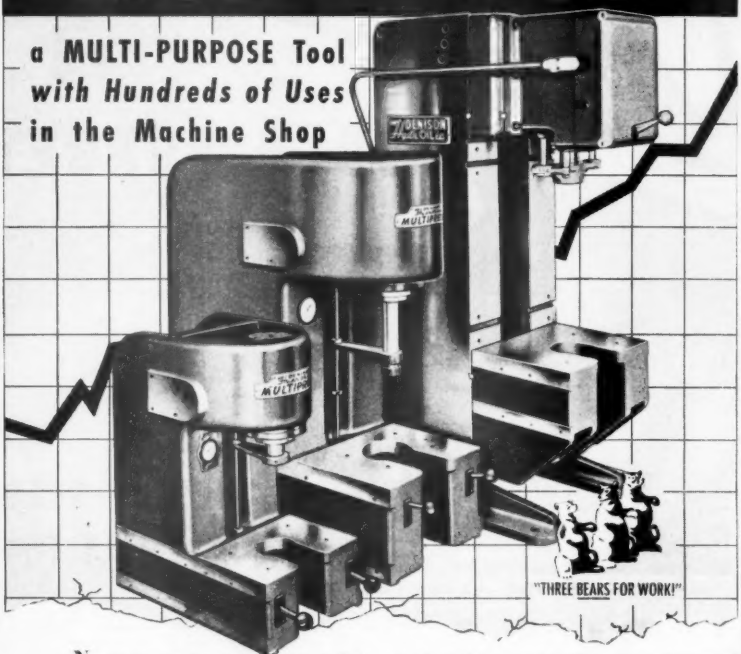
MULTIPRESS

a MULTI-PURPOSE Tool *with Hundreds of Uses* in the Machine Shop



NEVER BEFORE has such *fully controlled power* been made so easy to adapt to so *many* operations! MULTIPRESS advantages are daily pointing the way to better results more quickly, at lower cost, on hundreds of installations.

The amazingly compact MULTIPRESS in front is available in four- and six-ton capacities. The center unit provides pressures up to eight tons. In the rear is an assembly of the ingenious MULTI-UNITS, which offer MULTIPRESS performance in self-contained components that give you exceptional latitude in arranging your own press design or tooling setups.

In addition, an extremely wide variety of standard, job-proved tooling accessories extend MULTIPRESS efficiency to countless specialized operations.

No matter *how* you're handling pressure-application jobs within the eight-ton range—no matter how different your needs may seem—MULTIPRESS may have production-boosting surprises in store for you. Write for information!

DENISON EQUIPMENT for APPLIED Hydraulics

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Ready-made to fit!

For rough grinding and snagging; for micro-inch accuracy finishing—on through the entire range of production and tool-room requirements, Simonds* Borolon and Electrolon Grinding Wheels meet the major needs of all industry. Thousands and thousands of combinations of various types and sizes of grain in as many different structures with Vitrified, Silicate or Resinoid Bond complete a "ready-made" line of abrasive products which permit perfect "fit" for all conditions. Simonds Grinding Wheels; Segments; Mounted Wheels and Points; Grains, Bricks and Sticks, effect production economies; bring new abrasive efficiency when requisitioned for specific jobs on specific materials under specific machine conditions.

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**Time-honored Borolon Abrasive Products are now distinguished by the name Simonds.*

SIMONDS ABRASIVE CO. *is a Division of*

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Other affiliated companies are Simonds Steel Mills and Simonds Canada Saw Co., Ltd.

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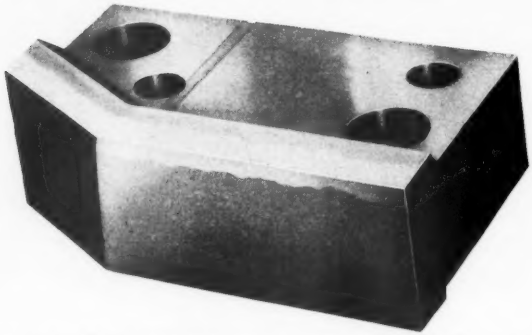
Compositely fabricate dies ... by WELDING



(Above) Composite-Fabricated Die. The Base is Mild Steel, the Cutting Edges "Hard-As-Welded" Deposits of Eureka Oil Hardening Tool Steel Electrodes.

EUREKA TOOL AND DIE WELDING ELECTRODES, for composite die fabrication, facilitate planning and effect speedy results. Plain carbon, S. A. E. or low alloy NE steels are used as a base and weld deposits of the various Eureka Tool and Die Welding Electrodes constitute the cutting edges or working areas. Units so constructed efficiently replace those constructed entirely of tool steel.

ELIMINATION OF HEAT TREATMENT

Deposits of Eureka Electrodes, which are "hard-as-welded", eliminate the need of complete heat-treatment after welding.

COSTLY MAINTENANCE AVOIDED

The ability to produce a composite tool or die results in a working surface of any desired characteristic with a resilient core.

CONVERTING INTO COMPOSITE UNITS

Convert existing tool steel die sections into composite units to meet unusual conditions.

MACHINING IS FINAL OPERATION

In composite fabrication by welding, finish machining, drilling, etc., can be done as final operations.

INSERTS ELIMINATED

Composite fabrication by welding eliminates the use of inserts, which are often too costly, unsatisfactory or impractical.

MULTIPLE APPLICATIONS

In composite fabrication by welding, it is practical to weld two, three or four types of unlike materials on one die unit to perform individual functions.

Also facilitates repairs to die units

EUREKA TOOL STEEL ELECTRODES "FIND THE SPOT"

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

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BARTH "CARBIDE" DIES set new horizons in razor blade production!

SO PHENOMENAL IS THE PERFORMANCE... so free the razor blade strip from any sign of increase in burr... that it is anyone's guess how many more hits Barth Carbide Dies will deliver before requiring sharpening.

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Carbide Dies may be the answer to your needs for stepped-up production. Why not discuss your problem with a Barth engineer.

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SPECIAL MACHINERY

BARTH

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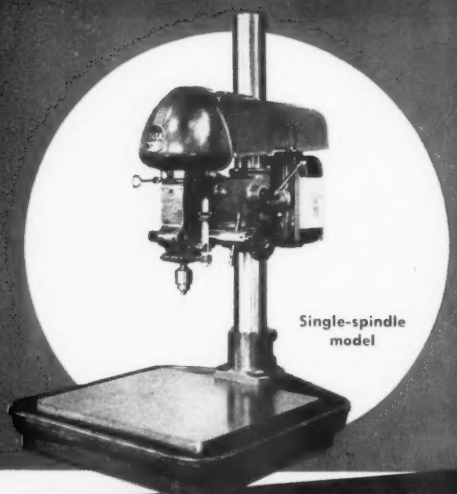
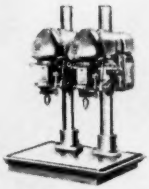


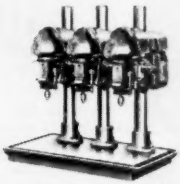
Single-spindle model

DELTA
MILWAUKEE
REG. U. S. PAT. OFF.



2-spindle model

A low-cost tool for greater accuracy on sensitive drilling from .025" to 1/4" diameter . . .



3-spindle model

Delta-Milwaukee Super-Hi*Speed Drill Press

All the well-known operating advantages of other Delta-Milwaukee drill presses, in a high-speed machine for small-hole drilling of plastics, aluminum, and other metals. Drills to the center of a 14" circle.

Famous Delta-Milwaukee features include: Lubricated-for-life ball bearings . . . Pre-loaded ball bearings . . . Precision-ground spindles . . . Dynamically-balanced pulleys . . . Dynamically-balanced motor . . . Specially-selected Jacobs chuck.

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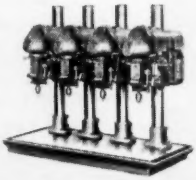
Send coupon for free catalog of low-cost Delta-Milwaukee Machine Tools.



4-spindle model

Subsidiary of Rockwell Manufacturing Co.

*Trade Mark Reg. U. S. Pat. Off.

---[Tear out coupon and mail today!]---

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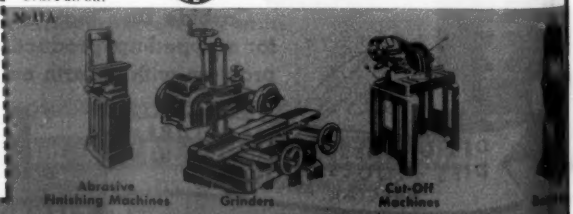
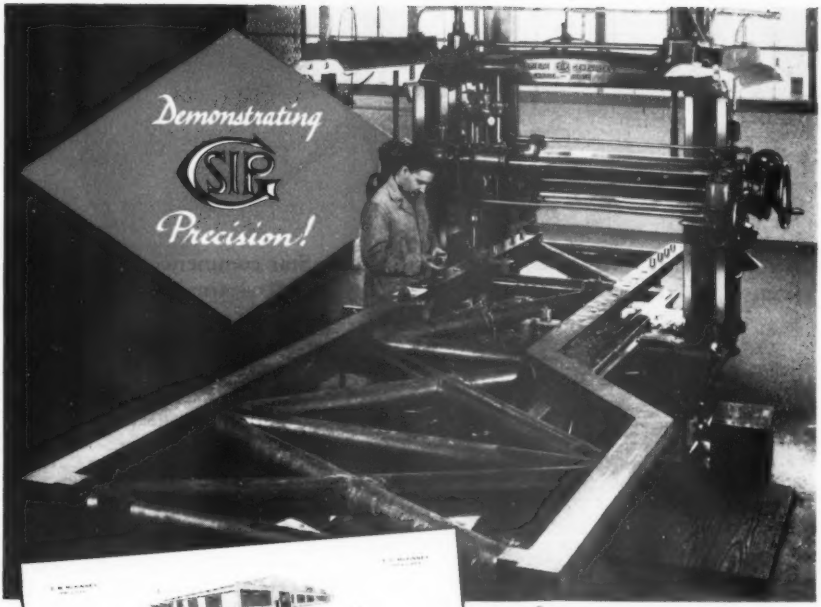


Abrasive Finishing Machines

Grinders

Cut-Off Machines



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McKINNEY Guaranteed

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Cosa Corporation
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Gentlemen:

We purchased a SIP Jig Borer in 1936 and have used this machine continuously ever since. During the war years it ran twenty-four hours a day, seven days a week.

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Thanking you for your cooperation in the past, we remain

Yours very truly

MCKINNEY TOOL & MFG. CO.

F. C. McKinney

F. C. McKinney

". . . by far the best Jig Borer on the market", says F. C. McKinney, who has put a SIP Jig Boring and Milling Machine to the severest test of continuous operation on jobs, like the one shown above. World famous SIP Jig Borers combine the high precision needed for toolroom work with the speed and dependability of set-up and operation that keep labor costs low—even on direct production.

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No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
Hydroptic-B	30½" x 32"
No. 5G	43⅝" x 32"

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COSA CORPORATION

COSA

CHRYSLER BUILDING
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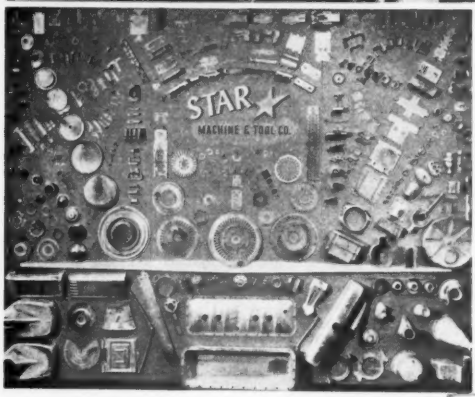

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Star commenced to build dies a long time ago—way back in 1902. We've built dies of all types and sizes, in our time, including many unusual and tough jobs, and we've accumulated a degree of experience and skill in die making that, we believe, is not excelled, anywhere.

We have an unusual production department, too, operated quite independently of our tool and die shop—a department capable of starting from your blue print or sample and carrying your job through tooling to final assembly, equipped with ample facilities for the manufacture of your metal component parts or complete products in any quantity.

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Name .....

Address .....

The new CINCINNATI Plain Hydromatic Milling Machine (No. 5-60 size illustrated). Catalog M-1372 contains complete specifications and details of features for both the Plain and Duplex styles.

● You can expect big things from the new CINCINNATI Hydromatics. They're heavier, and much more powerful. They incorporate all the time-proved Hydromatic features, plus many new and exclusive advantages which make them especially useful for heavy cuts and rapid metal removal on all types of metals, and using all types of cutters including sintered carbide. The new CINCINNATI Hydromatics are built in twelve sizes, in Plain and Duplex styles, ranging from 24" to 90" table travels, powered by 7½ to 30 h. p. motors (higher if desired), depending upon the size of the machine. Catalog No. M-1372 contains complete specifications and other important details. A copy of this informative book is yours for the asking.

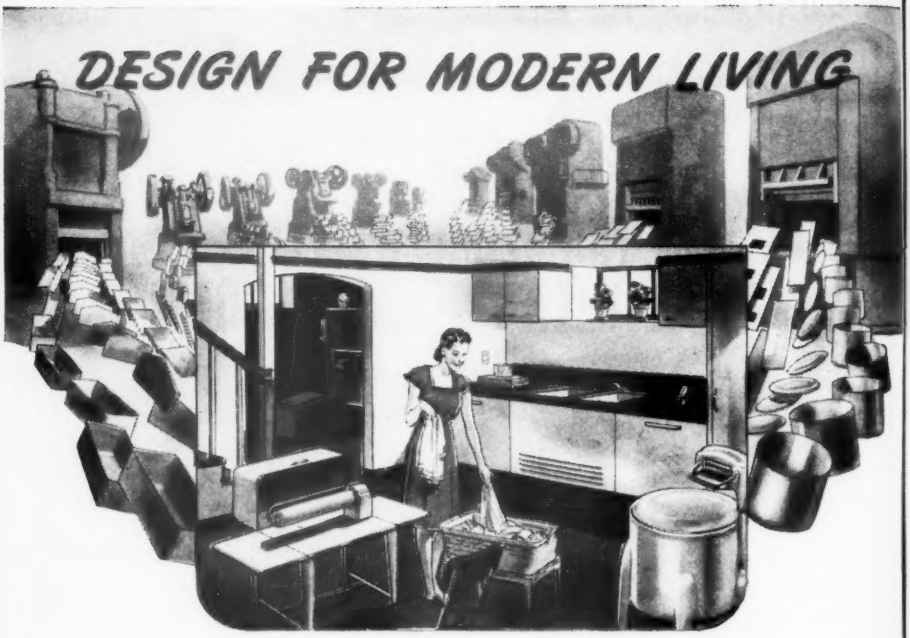
Introducing
THE NEW CINCINNATI HYDROMATIC MILLING MACHINES

The new CINCINNATI Hydromatics are built in Duplex styles, too. This illustration shows the largest standard size, a No. 56-90, tooled up to mill the channels in cast steel journal boxes. Here is concrete evidence of the ruggedness and cutting capacity of these new machines. Both spindles are taking a cut $\frac{3}{8}$" deep by 11" wide (the full diameter of the cutters).

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES



in Press Production Today

Designed for press production, the stamped products reaching the American Home—the new washing machine, electric ironer, stoker and metal cabinets—create a new design for living. The once messy basement becomes a modern, pleasant workroom.

Wherever stamped products are being turned out, Danly Die Sets and Die Makers' Supplies guarantee precision, speed die making programs and cut "down time," because Danly means *known dependable accuracy*.

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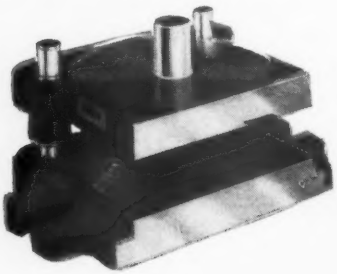

DIE MAKERS' SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication

Just imagine grinding parts flat within six millionths of an inch and with so fine a finish that they can be "wrung" together. Such superfine finishes to meet exacting requirements of modern industry, are possible with DoALL Precision Grinders.

Hydraulic Operation

DoALL Grinders are "liquid" powered for extremely smooth, vibrationless performance. No Backlash! The extra weight of the scientifically stabilized castings is distributed throughout the machine. Only DoALL has a massive one-piece base and column support to assure utmost rigidity. All ways are handscraped. Lubrication is automatic.

Fingertip Control

Recessed switches, handwheels for feed and other controls, all within easy reach, provide ease of operation. Hydraulic action can be changed instantly to complete manual control.

Accessories

There's no need to purchase accessories separately when you can get them all right with the DoALL grinder as a completely packaged unit.

Does Everything

Seeing the DoALL Grinder operate will be a revelation in what a surface grinder should be and do. Write for 20-page circular or phone nearest DoALL Service Store for demonstration.

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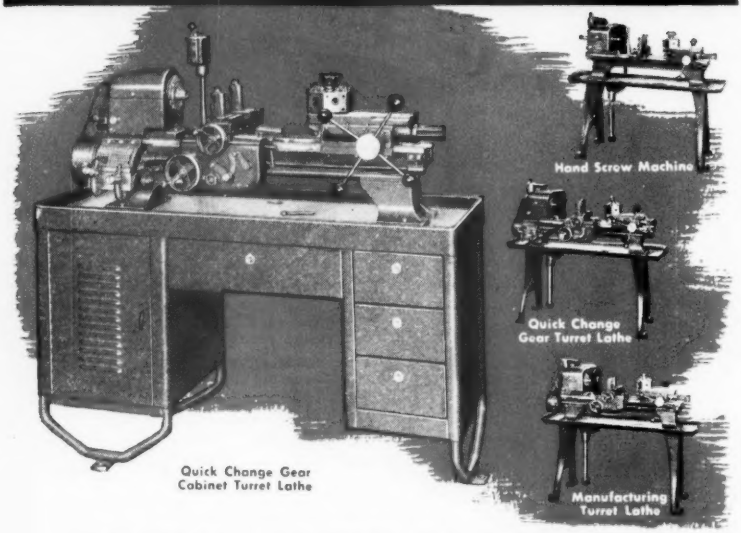
FILING MACHINES • SAW and
FILE BANDS • PRECISION
INSPECTION INSTRUMENTS
VARIABLE SPEED PULLEYS
POWER MEAT SAWS

The DoALL Company

DoALL STORES
IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION
MINNEAPOLIS 4, MINN.

Logan A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES



LOGAN TURRET LATHES

For Speed, Accuracy, Ease and Economy on a Wide Variety of Work

The speed, accuracy and versatility which made Logan Turret Lathes so effective in war production now bring increased efficiency and decreased costs to peacetime operations. Ruggedly, accurately constructed, with heavy hexagonal turrets, they handle a wide variety of operations with the precision essential to fine work. Quickly, easily set up, they minimize time loss between jobs. Heavier, more expensive equipment is released for larger work. Production and efficiency are increased and unit costs reduced. Logan advanced design and rugged, careful construction assure sustained accuracy. Spindles, mounted on special New Departure Ball Bearings, require no adjustment within the full speed range of 30 to 1450 rpm, and permit using high speed carbide cutting tools to full advantage. The two V-ways and two flat ways on the rugged beds are precision ground to within .0005" of parallelism. It is accuracy like this that makes ordering Logan Turret Lathes now a sound preparation for production jobs ahead. Ask your Logan Lathe dealer, or write direct for full information.

SPECIFICATIONS COMMON TO ALL LOGAN TURRET LATHES . . . Swing over bed, 10½" . . . bed length, 43" . . . size of hole through spindle, 25/32" . . . distance across turret head flats, 5¼" . . . 6 positions with adjustable stops . . . self indexing . . . maximum stroke of turret, 4¼" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision ground ways, 2 V-ways, 2 flat ways.

1-2

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

Circle "C" is the out-and-out choice of many for maintaining peak production and limiting "down-time." Write today for full information, or ask for a convincing demonstration in your own shop.

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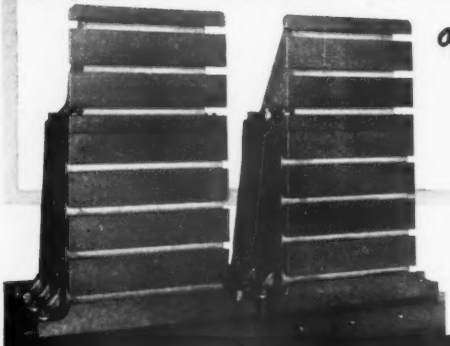
STEEL COMPANY

McKEESPORT, Pa. · NEW YORK · HARTFORD · PHILADELPHIA · PITTSBURGH · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

A *New* HIGH IN A COMBINATION *of* MATCHED *Angle* BLOCKS!

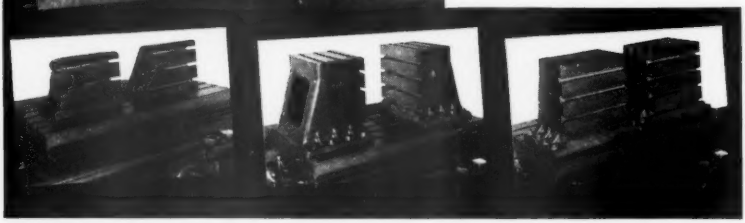


TOP MEMBERS—Vertical Face—12" High, 16" Wide—3 Tee Slots.

BOTTOM MEMBERS—Vertical Face—18¼" High, 16" Wide—4 Tee Slots.

TOP FACE—12" Deep, 16" Wide—3 Tee Slots.

TEE SLOTS—13/16" Wide, 4" Centers.



THIS combination of matched units serves convenience and rigidity for accurately locating and chucking work when boring, milling, planing or for other toolroom and general use. They can be used singly or in variety of combinations for large or small work.

They are machined from box section castings, with Tee slots and flat surfaces in precise alignment.

They are made with the same tooling and quality as the JIGMIL table.

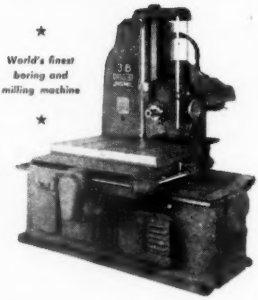
Each set includes Tee slot nuts, studs and screws.

Write for price and delivery!

★

World's finest boring and milling machine

★

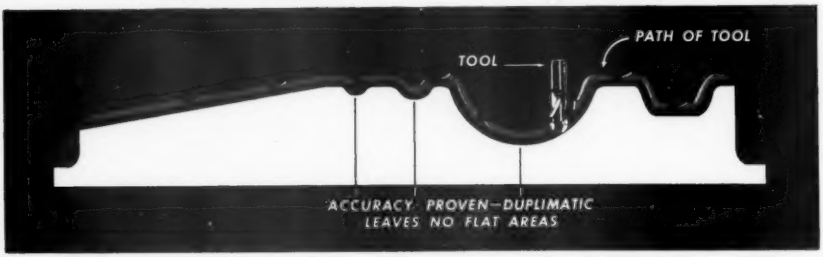


DeVLIEG MACHINE COMPANY DeVLIEG JIGMIL **454 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Big Acceptance!
FOR SENSATIONAL NEW AIR SCREW DRIVER
FOR RADIOS
FOR CAMERAS
FOR ELECTRICAL APPLIANCES
FOR INSTRUMENTS
FOR RECORDING DEVICES
FOR TYPEWRITERS
It's the same picture everywhere—great acceptance greets the arrival and use of the new ARO Model 7000 Air Screw Driver on the assembly lines of scores of industries!
No other tool like it! This pneumatic powered screw driver is no bigger than the average cigar. Weighs only 8 oz. . . . is 4 7/8" long and 3/4" in diameter. Capacity No. 1 to No. 6 screws. Starts automatically—no manual throttle. Drives the screw instantly when tool is applied.
Similarly, ARO Tools speed up and improve efficiency of countless other production jobs . . . including all types of screw-driving, nut-setting, drilling, grinding and other operations. Backed by ARO-engineered accuracy . . . built for dependability. Write for catalog. The Aro Equipment Corp., Bryan, Ohio.
Specify ARO
PNEUMATIC TOOLS

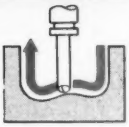
HERE'S *Just One* OF MANY REASONS WHY **DUPLIMATIC** IS THE ULTIMATE IN DUPLICATING MACHINES

Uniform Rate of Feed

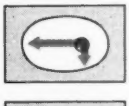


The irregular shapes of the above pattern are automatically machined at uniform speed and depth of cut by a DUPLIMATIC control attached to a standard milling machine. Rate of feed is as high as cutter and work piece will allow. Rate of feed is *uniform*, regardless of the contour, due to DUPLIMATIC'S *inverse feed control*—an exclusive feature—requiring no manual adjustment. This feed control is essential for most efficient processing, as the sharpest angle of climb need not be a consideration in the feed rate used, and allows for feeding *into* as well as *out of* the work piece. DUPLIMATIC, the electro-hydraulic control, is interchangeable with most types of machine tools. It does not interfere in any way with standard operation of the machine tool.

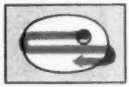
Die Sinking



WITH FEED IN ANY DIRECTION



WITH INDEXING



Contouring

ALL these operations are possible with one DUPLIMATIC control attached to a standard milling machine.

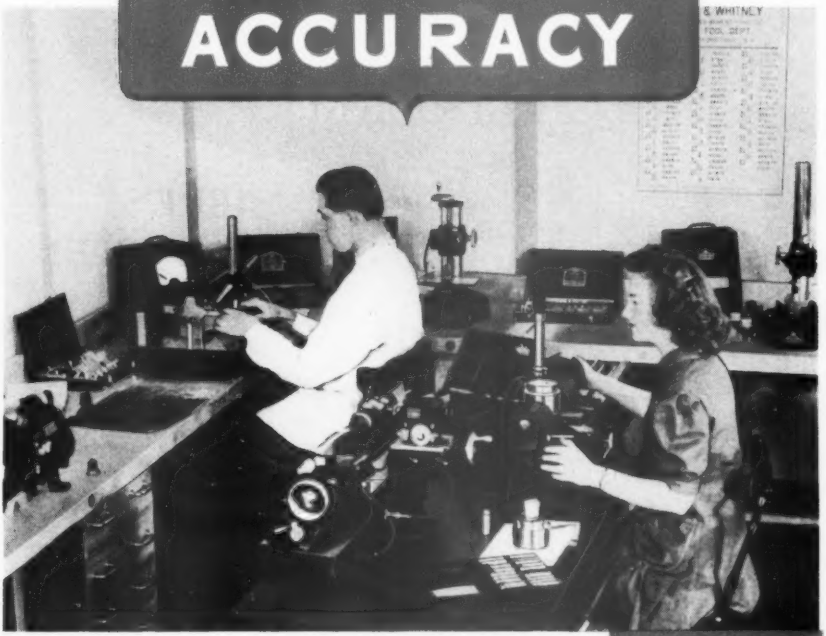
DETROIT UNIVERSAL DUPLICATOR CO.

18100 RYAN ROAD DETROIT 12, MICHIGAN

Write Today

Tell us what kind of work (production or tool room) you are doing. We'll tell you how DUPLIMATIC will speed your work, eliminate the need for special machine tools. No obligation. Send complete data.

How to Maintain ACCURACY



Somewhere in every shop, whether large or small, is a place devoted to precision measurement. Whatever its size, this measuring control is one of the most essential places in your plant.

The importance of precise measurement increases as the tolerances become closer. Industry is finding out that when the working limits have been selected and adhered to properly, the product will assemble easily and quickly, thus lowering the production cost.

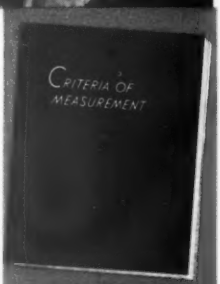
The war set new standards of measurement. Peacetime competition may require even higher ones.

What are today's
CRITERIA OF MEASUREMENT?

If you are seeking the answer to this question, or if you are planning a "Standards Room" for the control of measurement in your plant, we want you to have this new booklet.

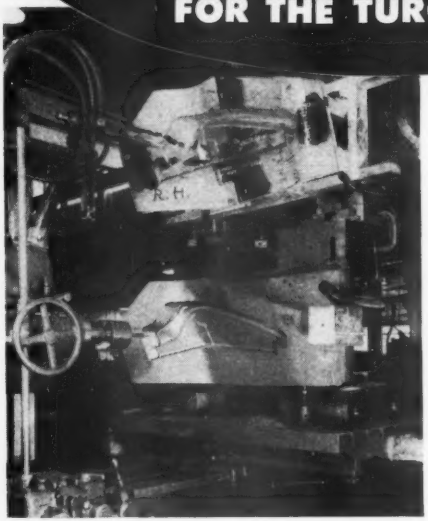
"Criteria of Measurement" is illustrated in full color. It tells you how to set up your own central measuring laboratory and describes the basic measuring equipment that will be needed in it.

Write for "Criteria of Measurement" on your firm letterhead.



PRATT & WHITNEY
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

DIFFICULT MACHINING JOBS ARE *Easy* FOR THE TURCHAN



HERE'S AN EXAMPLE!

•

Machining
Variable Curves
Radii and Blends

•

Impossible
Without the Aid of
A Duplicating Machine

The difficult job of machining the uneven surfaces of an automobile die, consisting of variable curves, radii and blends, becomes remarkably simple with the help of a Turchan Hydraulic Follower Attachment.

This is because the Turchan, working from a model of plaster or wood, duplicates all contours. Just throw in the feeds, and the contours of the model are duplicated automatically —without any skill being required on the part of the operator.

The Turchan is applicable to a great variety of machines—lathes, boring mills, planers, shapers and milling machines—all that is necessary being to install Turchan controls. Surprising as it may seem, the Turchan does not interfere at all with the ordinary use of the machine, disengagement being made, whenever desired, in 5 minutes' time.

Investigate this time-saving, cost-reducing machine that is paying for itself many times over every year in jobbing shops throughout the nation.

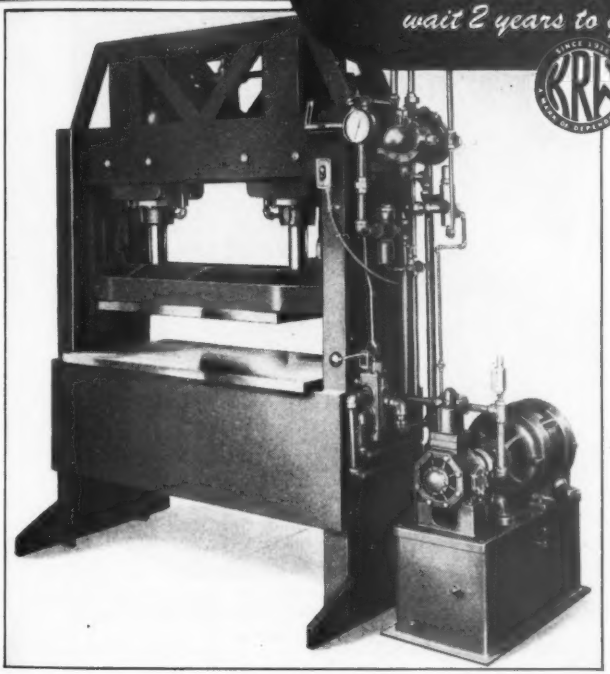
Write for Complete Information—"Duplicating Is Our Business"

TURN TO **TURCHAN** Hydraulic Follower Machine

TURCHAN FOLLOWER MACHINE CO.
8257 Livernois • Detroit 4, Mich.

HERE'S TOMORROW'S FORMING PRESS *Today!*

KRW ENGINEERING SCOOPS THE FIELD WITH THIS LOW-COST . . . SUPER-EFFICIENT . . . LIGHT-WEIGHT BLANKING AND FORMING PRESS . . . *and you don't have to wait 2 years to get delivery.*



Read these Specifications

KRW 80-TON BLANKING, FORMING AND STAMPING PRESS

Lower Face Plates	24"x34"
Upper Face Plates	20"x34"
Day Light	14"
Platen travel	7½" Automatically Controlled Stop
Height overall	88"
Width Overall	82"
Ram Pressure	80 tons
Platen speed	8 feet per min.
Return	11 feet per min.

● One of the soundest developments to come out of the war technology was the trend toward lighter and more efficient machine tool equipment. Startling proof of that development can be found in the new KRW 80-Ton Blanking and Forming Press. In this unit, KRW engineering experience has discarded tons of needless weight and cut thousands of dollars in cost from previous conceptions of this type of press.

All this has been done without any sacrifice in operating efficiency.

These new KRW Presses can consequently be built and delivered in a matter of weeks, *not years*. They can be built with open or closed ends and with greater or less capacity than the one illustrated. Tell us what your problem is, and we will engineer a press to solve it. Mail the coupon for our new Hydraulic Press catalog.

K. R. WILSON
BUFFALO 3, NEW YORK

K. R. WILSON, 215-217 Main Street, Buffalo 3, N. Y.
Please mail me a copy of your New Hydraulic Arbor Press Catalog.

Name .....

Address .....

City & Zone ..... *State* .....

CLE-FORGE HIGH SPEED DRILLS

on special set-ups

The CLEVELAND TWIST DRILL COMPANY
CLEVELAND 14

CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

PRECISION REID SURFACE GRINDERS

CONTROLS

"At your fingertips"

Whether your shop

IS SMALL OR LARGE, THE USE OF A *REID PRECISION SURFACE GRINDER* **WILL BE OF GREAT VALUE TO ASSURE (WITH A MINIMUM OF EFFORT)** *PRECISION RESULTS.* **TAKE ADVANTAGE OF ALL THE IMPROVEMENTS THAT ARE INCORPORATED IN REID MACHINES. NEW ILLUSTRATED BULLETIN GIVING FULL SPECIFICATIONS WILL BE SENT PROMPTLY ON REQUEST.**

BALANCED DESIGN—ATTRACTIVE FINISH
MODERATE COST

Illustrated is the REID Model 2-B
All-Electric Power Feed.

The Reid Model 2-C Hand Feed also is an exceptional machine for tool, gage, die and certain production grinding.

MACHINES EQUIPPED FOR WET GRINDING IF REQUIRED

EXCELLENT DELIVERIES

Distributors conveniently located in all sections.

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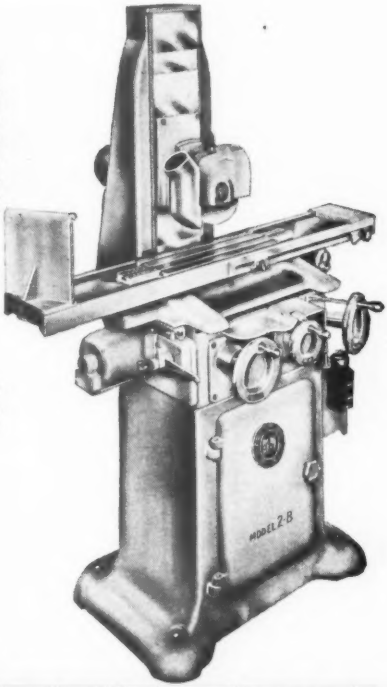
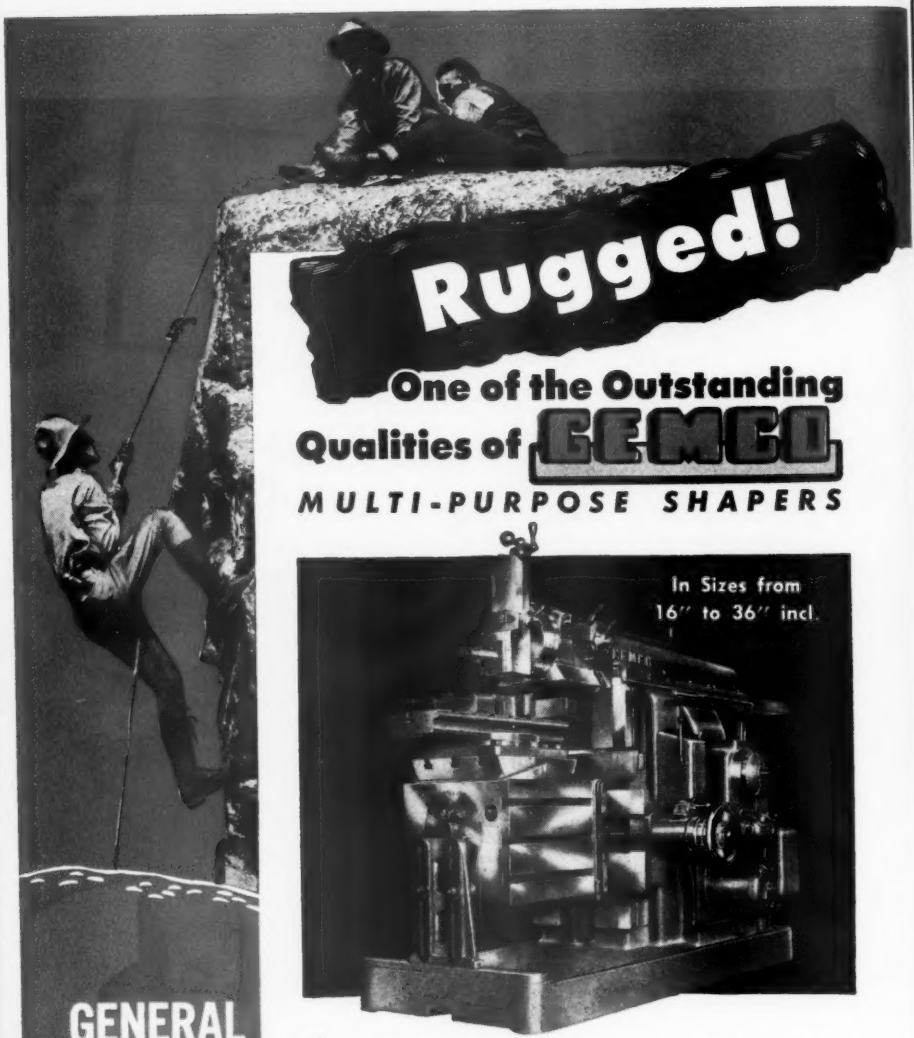
For Illustrated Bulletin and Prices.



REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS



Rugged!

One of the Outstanding Qualities of GEMCO

MULTI-PURPOSE SHAPERS

Several hundred users were recently asked: "What do you like most about GEMCO Shapers?" RUGGEDNESS was voted one of the most outstanding features. Because of this powerful construction, GEMCO Shapers have exceptional rigidity, stamina, and ability to "take it". Hence, they are extremely accurate, giving all work a precision finish.

The Universal type of GEMCO Shaper, shown here, is ideal for tool and die work, or where angular setups are required. Its exclusive "Lubrigard" Safety Device increases the precision life.

GENERAL ENGINEERING & MFG. CO.

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ST. LOUIS 4, MO.

Manufacturers of Precision Machinery Since 1917

Write today for Bulletin GC-12D

THE *World's Fastest* VISE

HEINRICH

Grip-Master

SCREWLESS VISE

Look for these EXCLUSIVE *Features:*

- Instantaneous, Effortless Setting.
- Positive Locking Guaranteed.
- Work Rests Parallel with Machine.
- Straight-Through Drilling.
- Long Range Loading and Unloading Capacity.
- Hardened and Ground Bars and Locking Mechanism.
- Costs No More than Common Drill Press Vises.

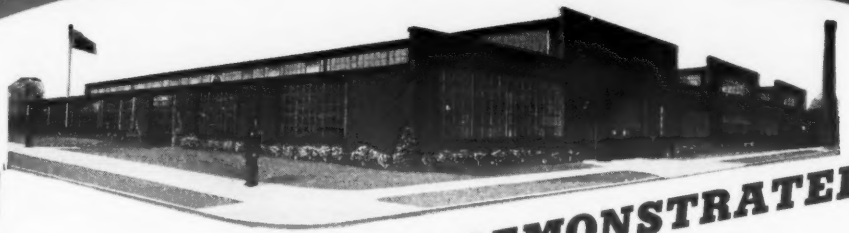
● The amazing new Heinrich "Grip-Master" is a SCREWLESS vise. It represents the most revolutionary development in a century of vise manufacture. The Heinrich "Grip-Master" operates effortlessly . . . the movable jaw is adjusted in a jiffy . . . and is locked securely with a press on the locking lever. Bars and locking mechanism are hardened and precision ground. Wide clearance between jaw guides permits drilling through the work. Removable V-jaw accessory makes drilling of round pieces easy. Four sizes fill every need. When you first see the "Grip-Master", you won't be able to resist trying it. Once you have tried it, you'll not be satisfied until you own it.

SEND FOR FULL DETAILS

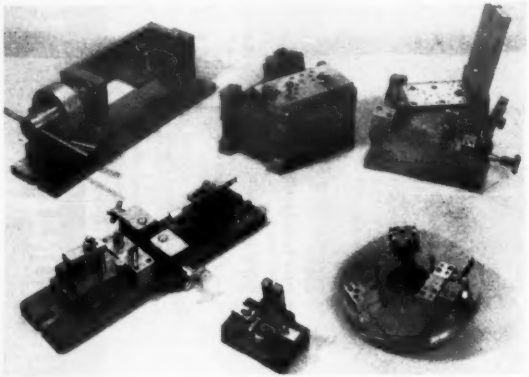
A postal card request will bring you an illustrated folder giving further details about the new Heinrich "Grip-Master". Investigate this new discovery today!

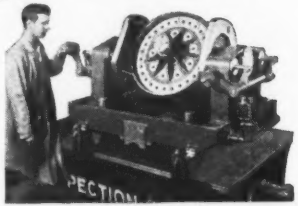
NATIONAL MACHINE TOOL CO. Dept. 136 F RACINE, WIS.

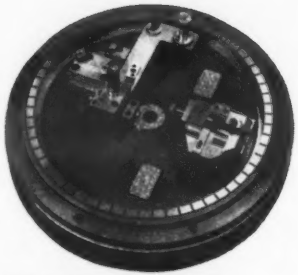
McKINNEY
CLEVELAND



WHERE
EFFICIENCY IS CONSISTENTLY DEMONSTRATED
IN THE PRODUCTION OF—



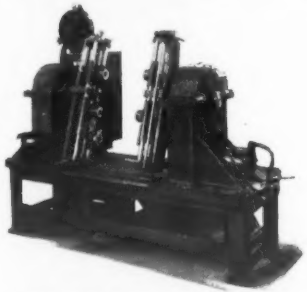




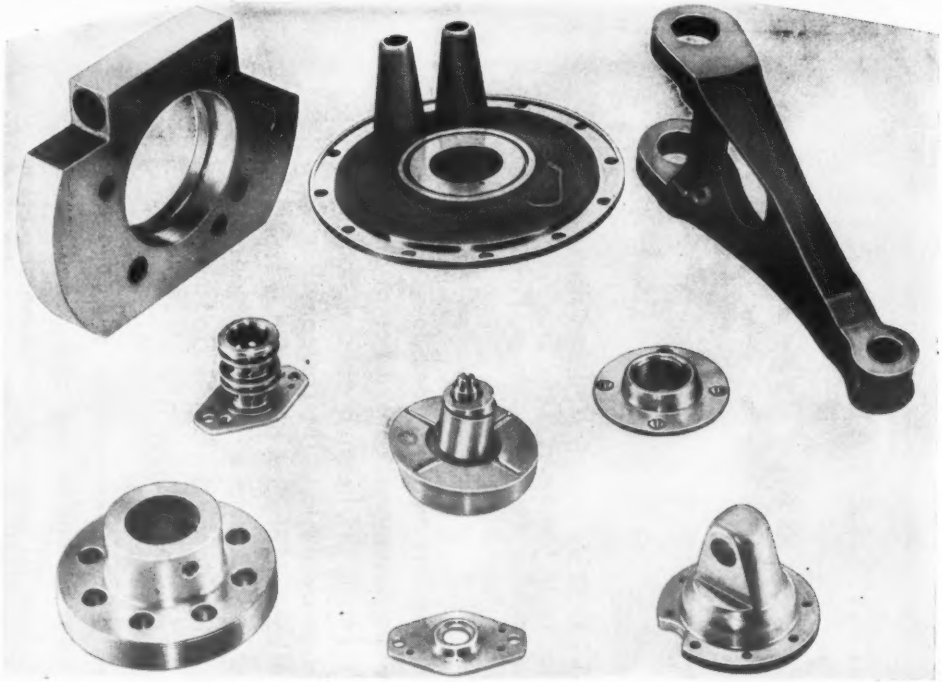
TOOL EQUIPMENT

PILOT
MODELS

SPECIAL PURPOSE MACHINERY



CONTRACT MACHINING OF PRECISION PARTS



WRITE FOR BULLETIN ILLUSTRATING AND DESCRIBING McKINNEY EQUIPMENT AND FACILITIES

McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGNERS and BUILDERS of PRECISION TOOLING Since 1920

1673 Arabella Road

Tools-Dies-Jigs-Fixtures-Special Machinery

STRAIGHT TALK ON . . .

Considering

BUNELL

for the DESIGN and MANUFACTURE of Special Tools, Machinery, Dies, Jigs, Gages, Fixtures and for the Production of Precision Parts and Assemblies.

The Bunell Machine and Tool Company is equipped to handle the design and construction of any type of metal stamping die, fixture or special machine — 175 machines available. The company has a successful background of 25 years — and is especially competent in suggesting efficient part design. It has done satisfactory work for leading firms in practically every kind of industry.

The plant is modern — skilfully streamlined for manufacturing savings in time and money. Machine units from 20 tons to precision metal parts in ounces, in any quantity, are handled at low cost. Jobs are done right, at prices that are fair — always competitive. Delivery promises are honored.

THE BUNELL MACHINE & TOOL CO.

1601 EAST 23rd STREET CHerry 0343 CLEVELAND 14, OHIO

THIS NEW *SUPER* TOOL BIT SAVES MONEY 7 WAYS!

Check These New *Super* Features For Lower Production Costs!

SUPER EJECTOR TYPE TOOLS
(Complete with 1 Carbide Bit)

Tool Order Number		Shank Size	Size Solid Carbide Insert
Right Hand	Left Hand		
ER-1	EL-1	¾x¾x4½	¼x¼x2
ER-2	EL-2	1x1x7	⅜x⅜x2
ER-3	EL-3	1¼x1¼x8	⅜x⅜x2
ER-4	EL-4	1½x1½x8	⅜x⅜x2
ER-5	EL-5	¾x1x6	⅜x⅜x2
ER-6	EL-6	1x1¼x8	⅜x⅜x2
ER-7	EL-7	1x1½x8	⅜x⅜x2

SOLID CARBIDE BITS for SUPER EJECTOR TYPE TOOLS

Tool Order Number		Size
For Steel	For Iron, Non-Ferrous Mat., Plastics	
ES-1	EG-1	¼x¼x2
ES-2	EG-2	⅜x⅜x2

NOTE: Above bits are ground to fit holder and require only sharpening at cutting end.

1. Bit-holding mechanism inside—can't interfere with chip flow or assembly in tool block.
2. Heavy cross section of well-supported Carbide permits deep cuts and heavy feeds without cracking.
3. Absence of brazing strains due to mechanical holding of tip.
4. Tool life doubled due to compound angles. When Carbide bit is ejected, it rises in holder, permitting light regrinding cuts.
5. No steel removed in grinding.
6. Replaceable Carbide bit is extra long.
7. Each holder can be used for any material. Carbide bits available in proper grade for every job.

SUPER TOOL CO. 21650 Hoover Rd., Detroit 13, Mich.
4105 San Fernando Rd., Glendale 4, Cal.

STEP UP YOUR PRODUCTION WITH GENESEE

INSERTED BLADE FACING and COUNTERBORING TOOLS

Production goes up and cost goes down when you use Genesee Facing and Counterboring tools. These features will convince you.

- Chip space is 100% efficient no matter how often blades are reground.
- Two styles with straight or morse taper shanks carried in stock.
- Standard sizes from 1¼ to 4 diameter.
- Furnished with high speed steel, cast-alloy or Tungsten Carbide tipped blades.
- Interchangeable pilots.
- Blades may be reset to exact diameter after regrinding.
- All tools have heat treated alloy steel bodies with ground thread for extreme accuracy.

Facing and Counterboring Tool

Another production increaser

GENESEE ADJUSTABLE HOLLOW MILLS

Let our Engineering Department solve your Production Tool Problems.

Write for Catalog 45–J

GENESEE MFG. CO., INC.
GENESEE
EST 1908
ROCHESTER 4, N.Y.

ADJUSTABLE HOLLOW MILLS • FACING AND COUNTERBORING TOOLS • SPECIAL PRODUCTION TOOLS

Meet Production Demands

DIEBEL **HI** $\frac{550}{RPM}$ **SPEED** PUNCH PRESS

Small Metal Stampings

TERMINALS — LUGS — WASHERS, ETC:

THIS SMALL
Accurate Punch Press Provides Speed and Economical Production

THINK
Up to 550 Strokes per Minute and Fully Automatic

IDEAL FOR PLASTICS — PAPER — FIBRE

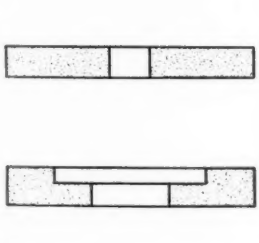
Write Immediately for Full Particulars

DI MACHINE CORPORATION

Division of Diebel Die & Mfg. Co.

3653 North Lincoln Avenue, Chicago 13, Illinois

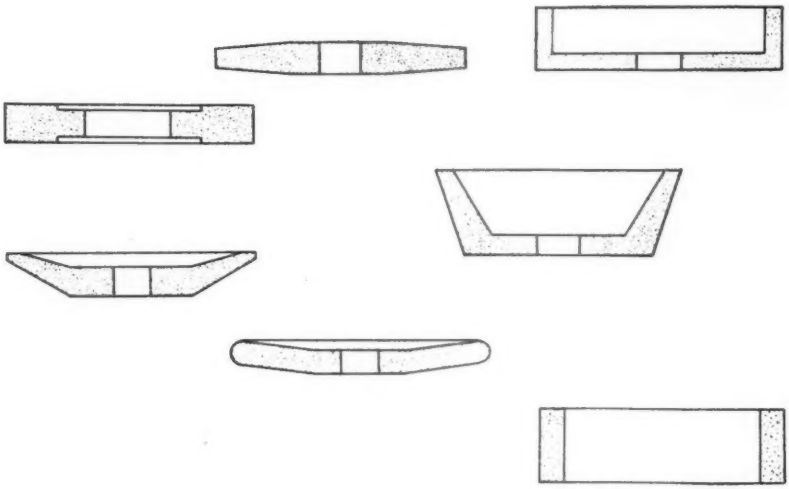
Sometimes a different shape determines better grinding



In terms of grinding wheel life, as well as efficiency and economy—the wheel shape selected for a specific operation is worth careful consideration. This is equally true for both production operations and tool-room grinding.

To help you check your grinding operations... to assist in selecting the best combination of shape, grit, grade and bond, follow the simple plan of many top notch production men. Consult with your CARBORUNDUM salesman or our distributor's representative. Many customers consider his opinions of real, practical value. His suggestions are based on a

A good rule for good grinding... **CALL**



knowledge of abrasive developments . . . supported by daily experience with plenty of on-the-job grinding applications.

If the problem is unusually difficult, the CARBORUNDUM representative may call in an Abrasive Engineer for consultation. Both representative and Abrasive Engineer have available to them the facilities and resources of the world's most noted abrasive laboratories.

Through this single practice, of calling in CARBORUNDUM, you can be sure of getting maximum efficiency from your grinding wheels and other abrasive products. The Carborundum Company, Niagara Falls, New York.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
Silicon Carbide
Aluminum Oxide
Diamond
Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

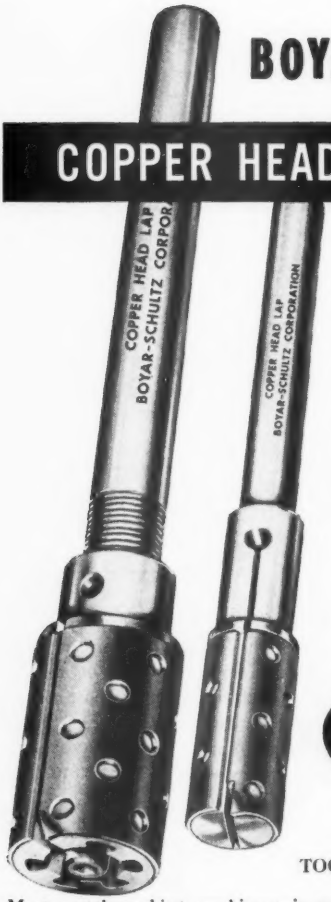
ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

BOYAR-SCHULTZ

COPPER HEAD LAPS



. . . They pay for themselves in time saved! They work fast; they never wear out. The only wearing part is the replaceable sleeve. Sleeve adjustment feature permits maintaining correct lapping size till worn out and replaced with a new sleeve. Costly toolroom time is saved by using Boyar-Schultz Copper Head Laps. Available from stock in standard sizes ⅛" to 2½".

"AVOID DELIBERATE RUIN OF MACHINERY"

SPECIAL MACHINE BOLTS

From A
Letter To
TOOL ENGINEER
Jan. 1946

Most metal working machinery is provided with T-slots in tables for fastening work. In modern production these T-slots are completely finished by milling or planing; consequently every surface is finished smooth and square. But when the machines are put in operation, any kind of hodge-podge bolt is used for fastening work. It does not take long use of a machine to ruin the T-slots with such bolts, and after that has happened, a most essential part of the machine is ruined. "The cost of proper bolts is very small, and I hope that my observations expressed here will reach the men in authority to *avoid this deliberate ruin of American Machinery.*"

Boyar-Schultz T-slot Bolts are made from upset forgings of heat treated alloy steels. Machined heads are square, with bodies to present a clean, flat surface to T-slot. Threads are carefully cut. For best results, use Nuts and Washers made for use with Boyar-Schultz Special Machine Bolts.

WRITE FOR CIRCULARS

BOYAR-SCHULTZ CORPORATION, 2112 Walnut St., CHICAGO 12

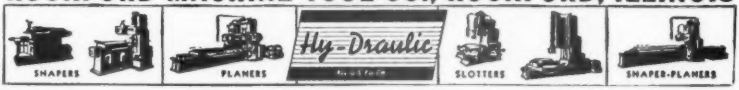
TAMING A "TOUGHIE"

The job on the 48" Rockford Hy-Draulic Openside Planer shown above would be a "toughie" to plane economically without this handy machine. The work consists of a pair of 84"-long cast iron saddles that have dovetails and bearing surfaces on opposite sides and at right angles to each other. Planing the saddles lengthwise is easy for any good 48" planer . . . and this Rockford Hy-Draulic Openside does a fine job on both saddles successively.

Planing the other side of these castings would require a larger and much more costly double-housing planer. On the 48" Hy-Draulic Openside the job remains easy because the castings can overhang the planer table 40" or more, on the "open" side, without interference. Planing both sides of both saddles takes only 29.7 hours floor-to-floor. This is really "taming a toughie," considering the amount of planing, number of tool-settings, accuracy, high quality of finish and set-up time required.

Rockford Hy-Draulic Openside Planers are made in four capacities and in various lengths up to 20 feet. They do first-class work on all ordinary planing and "tame" lots of "toughies" besides. Investigate these Rockford Hy-Draulic machines today. Write for Bulletin **2519**.

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS



The crying need for a gear cutting machine which could keep pace — gear for gear — with the output of gear finishers has now been filled by the new line of Michigan SHEAR-SPEED gear shapers which will cut gears as accurately as they can be cut by any high production gear cutting machine and *cut them as fast as you can finish them.*

A SHEAR-SPEED and a Michigan Gear Finisher is a gear-cutting "UNIT." You can now plan your gear production in "Units" per hour or per day, also saving countless machine hours, and producing better gears at lower cost.

Write for bulletins.

MICHIGAN TOOL COMPANY 7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

Now

A TOOL HOLDER WITH VERTICAL ADJUSTMENT

..FOR USING BORING TOOLS IN LATHES

A simple, quick turn of a knurled screw moves tool in vertical plane for precision setting. Use of shims is eliminated. Positive locking device.

Screw has Acme thread, hardened and ground. All parts made of alloy steel, heat treated.

SEND FOR CATALOG E 464

TWO SIZES: BT-1—½ x 1¼"
BT-0—⅜ x 1"

TRADE MARK REG. U. S. PAT. OFF.

BOKUM TOOL CO.

14775 WILDEMERE AVE. · DETROIT 21, MICH.

SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS

PRECISION CENTERED EYE BENDING

with

DI-ACRO BENDERS

DI-ACRO precision bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

Send for Catalog

"DIE-LESS" DUPLICATING

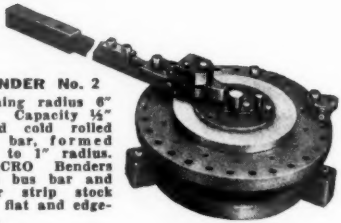
showing many kinds of "DIE-LESS DUPLICATING" produced with DI-ACRO Benders, Brakes and Shears.

A Centered EYE in 1 Operation

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at a high rate of production. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

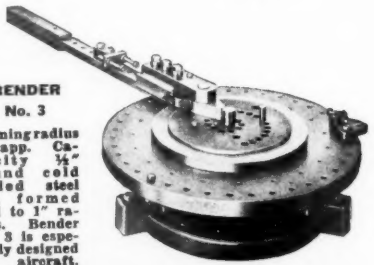
BENDER No. 1

Forming radius 2" app. Capacity 7/32" round cold rolled steel bar or equivalent. All DI-ACRO Benders have two-way action, right or left hand mounting and reversible forming nose.



BENDER No. 2

Forming radius 6" app. Capacity ½" round cold rolled steel bar, formed cold to 1" radius. DI-ACRO Benders form bus bar and other strip stock both flat and edgewise.



BENDER No. 3

Forming radius 9" app. Capacity ¼" round cold rolled steel bar, formed cold to 1" radius. Bender No. 3 is especially designed for aircraft, marine and other large radius bending.

DI-ACRO IS PRONOUNCED "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 8th Ave. S.
Minneapolis 15, Minn.

Dowel Pins

They serve as locating pins for the die-maker's work — and then go on to general duty as pins and pivots in various machine assemblies.

By their accuracy and strength they *retain* precision standards in tool and die and machine assemblies under punishing stresses.

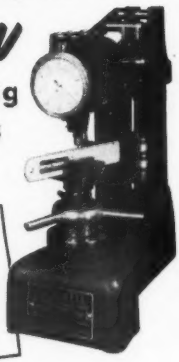
They are ground to a limit of .0002" over basic size, with an allowable tolerance of plus or minus .0001". Surfaces are finely polished; subsequently treated with a rust-preventive.

Metallurgically in a class with ALLEN Hex-socket Screws: — made of the same special-analysis *ALLENOY* steel, heat-treated to an extremely hard surface, with a core of the right toughness to prevent "mushrooming" when driven into a tight hole . . . Tensile strength, 240,000 to 250,000 lbs. per sq. inch. Ask your local ALLEN Distributor for samples and dimensional data.

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, ★ ALLEN ★ CONNECTICUT, U. S. A.

MILFORD
PROFILE SAW

for all contour sawing, jig and band saw machines



EDGE HARDENED
Teeth as hard as a hack saw blade—long endurance.

TOUGH AND FLEXIBLE — Made from electric furnace saw steel—side wear reduced to a minimum.

MILLED TEETH — Uniformly sharp for fast cutting.

PRECISION SET—Will follow a straight or contour sawing line accurately.

•

Backed by the "know-how" of saw specialists since 1876.

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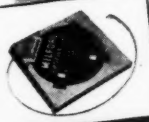
Order from your Mill Supply Distributor. He is always ready to serve your needs for all factory and mill supplies, as well as Milford hack saw and band saw blades.

The MILFORD PROFILE dispenser box was designed to insure maximum strength. The corners are supported by wooden blocks which prevents any crushing or binding. No binding wires are used. Simply run out, measure and cut desired length. Done in a jiffy. Saves hands and guards coil against corrosion. All boxes plainly labeled



MILFORD
PROFILE AND BAND SAW BLADES
FLEXISTOR AND DUPLEX HACK SAW BLADES

THE HENRY G. THOMPSON & SON CO.

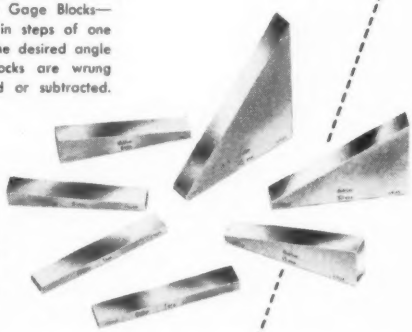
Saw Specialists Exclusively for Over 65 Years
NEW HAVEN 5, CONNECTICUT, U. S. A.

PRECISION . . .

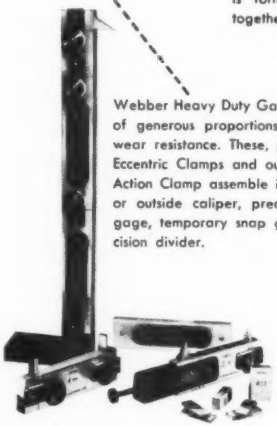
at a Price to Suit Your Shop

Webber Micro-Accurate Gage Blocks are furnished individually or in sets to meet the need and budget of your shop. These long-wearing, finely-finished gage blocks bring precision in millionths within the reach of every shop.

370,800 angles are possible with the new Webber Angle Gage Blocks—0 to 103 degrees in steps of one second of an arc. The desired angle is formed when blocks are wrung together and added or subtracted.



Webber Heavy Duty Gage Blocks are of generous proportions for greater wear resistance. These, plus Webber Eccentric Clamps and our new Quick Action Clamp assemble into an inside or outside caliper, precision heighth gage, temporary snap gage or precision divider.

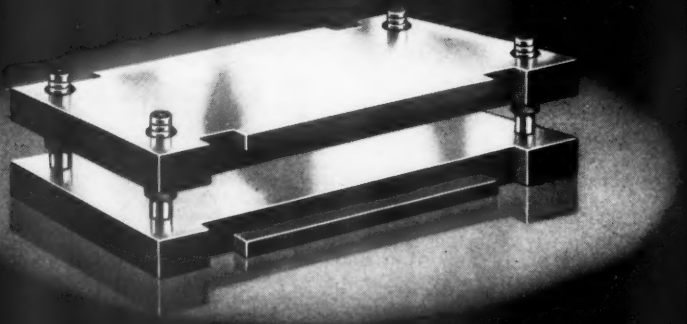


Webber

GAGE COMPANY

12903 Triskett Road • Cleveland 11, Ohio

Finely Made Special Die Sets



We are well qualified by experience and well equipped mechanically to produce special die sets of the highest quality. Send us your prints or call the "Detroit" man in your area. We also supply standard die sets in all sizes, and all kinds of accessories.

CALL "DETROIT"

DETROIT	TR 2-5150
INDIANAPOLIS	LI 3884
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DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SETS ★

Multi-Section Hole Grinding in One Simple Set-up

Looking at this 10 station progressive die with 100 holes to be located and ground to .0002" tolerance in the die and stripper inserts, you'd hardly call it a single set-up job. But it is on the Moore Jig Grinder.

On this unique machine *all the sections can be screwed and doweled into place, strapped on the table and ground in one set-up* . . . eliminating separate section hole grinding and the difficulty of accurately locating each section in the die bed.

Finish-grinds holes within .0001" . . . straight or tapered.

Hardening distortion is quickly and accurately corrected. The Jig Grinder relocates holes, finish-grinds them—straight or tapered, within .0001"—removes the decarburized surface and produces a smoother finish. All this in *one-third* the time required by previous, more costly methods. And more uniform clearance between punch and die adds from 25% to 100% to the life of a Moore jig-ground die.

You'll want to know more about what this machine can do for you, why it is considered a toolmaker's "must," how the Moore Jig Grinder put die-making on an interchangeable parts and assembly basis. So write today for our technical bulletin.

MOORE SPECIAL TOOL CO., INC.
726 UNION AVENUE, BRIDGEPORT 7, CONN

MOORE TOOLS

MOORE Jig Grinder

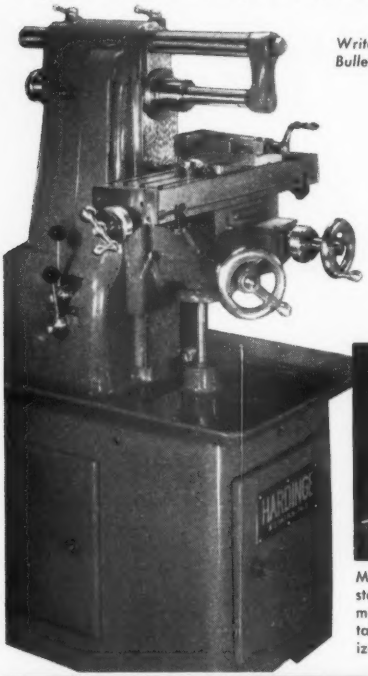
THE ONLY MACHINE OF ITS KIND

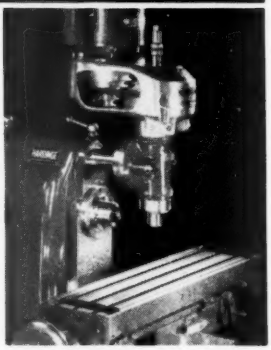
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION
MILLING MACHINE
FOR
TOOL ROOM AND LABORATORY

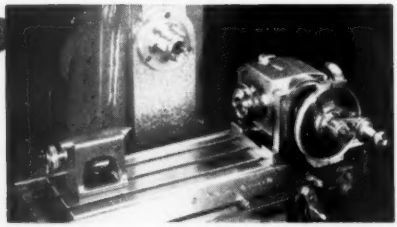
Tool room and laboratory work, because of the variety, demands useful milling machine attachments. Hardinge knows this. Illustrated are two attachments, in addition to the arbor and vise shown below. Other attachments are: Power feed for table; oil coolant facilities; 360° swivel base, also right angle base for dividing head; taper hole collets, as well as regular collets; step chucks and jaw chucks for dividing head.

Write for Bulletin TM-UM



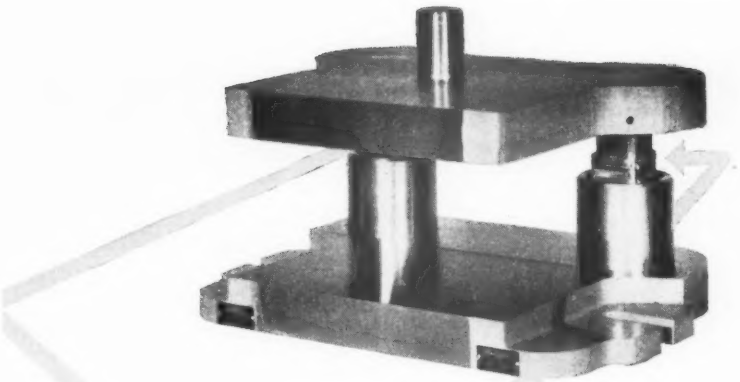


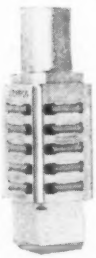
This attachment provides high speed vertical milling. Has separate motor driven preloaded ball bearing spindle —eight selective speeds from 465 to 4250 r.p.m. — takes standard ½" capacity collets. Vertical head swivels to angular settings.



Modern design universal plain dividing head and tailstock. Designed to match the precision qualities of the machine. Features are: Preloaded ball bearing spindle; takes standard 1" capacity collets same as used in horizontal spindle; and high speed indexing, 4 to 1 ratio.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE





SQUARE PIN ROLLER BEARING

A New Feature

HAS BEEN ADDED

ROUND PIN BALL BEARING

To cut repairs—to reduce downtime—to increase production—use Lempco Anti-Friction Die Sets.

These are the only sets equipped with ball or roller bearing guide pins which makes it easy to set up dies by hand without the use of hammers, mauls, jacks or pry bars. This eliminates expensive accidents to dies and punches—saves up to 60% of mechanics' time and permits fast press speeds.

All bearings made with .0015" pre-load to eliminate "play" between the pin and bushing. Over 18,000,000 strokes in actual production failed to destroy pre-load and proved that this feature guarantees long die life —assures greater production between sharpenings.

For complete details on the revolutionary Lempco Precision Anti-Friction Die Sets, write for catalog.

LEMPCO

5713 DUNHAM RD., BEDFORD, OHIO

PRECISION

- Dynamically balanced design.
- Guaranteed to turn or bore within .0002" dia. in five inches.
- Self-centering collet work-holding method.
- Vibration-free ball-bearing spindle.
- Positive turret re-indexing within .0003".

VARIETY

- Eight successive operations finish-machined at one chucking.
- Internal or external thread chasing.
- Double tool slide for straight or taper turning, forming or cutting off.
- Uses push-out or draw-in collet, step or jaw chuck.

EASE OF OPERATION

- Single lever spindle speed control.
- Self-locking turret head.
- Positive stops for duplicating size.
- Vee-belting replaceable without disturbing spindle or drive.
- Automatic brake; pneumatic bar feed.

The Rivett No. 918 Plain Cabinet Turret Lathe is an efficient producer of small duplicate parts. The combination of true running work and precise tool indexing creates a place for this turret lathe in fine manufacturing.

If you have a production problem requiring second operation or initial machining of small finely made parts from stainless steel, brass, plastic or other material, the Rivett 918 guarantees a lower cost solution. Write for Bulletin 918T.

RIVETT

ARMY E NAVY

RIVETT LATHE & GRINDER, Inc.

BRIGHTON • BOSTON • MASS. • U. S. A.

Added POWER to

PUSH PULL LIFT or Lower

ANKER-HOLTH

NON-ROTATING CYLINDERS

AIR and HYDRAULIC

"AIRGRIP" Non-Rotating Cylinder mounted on tailstock of Sundstrand Lathe.

Note precision construction and ease of disassembling.

HI-POWER DOUBLE-ACTING NON-ROTATING CYLINDERS, either air or hydraulic, deliver fast, smooth, dependable power. They are available in a variety of mountings and with any length of stroke to meet your individual requirements. *Extra* strong cylinder walls (9/16" thick); no tie rods; makes servicing easy—either end of cylinder quickly removable.

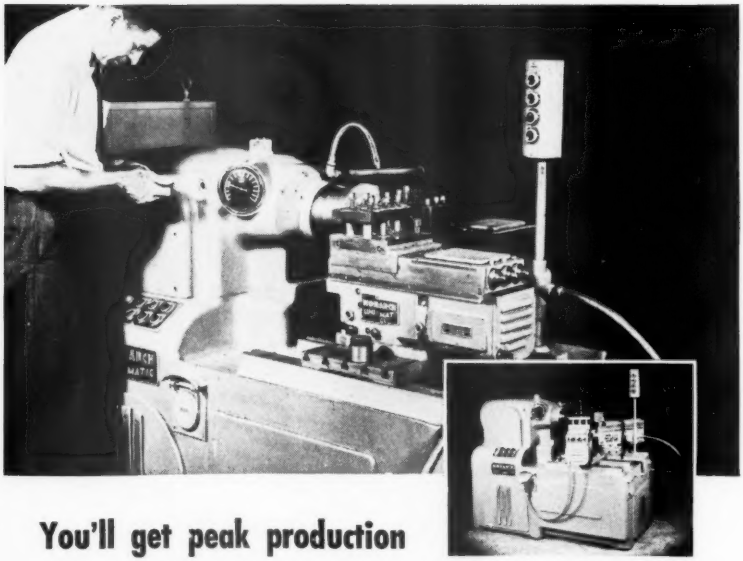
AIRGRIP

OTHER ANKER-HOLTH PRODUCTS—Air or Hydraulic 3- and 2-jaw Chucks, Collets, Arbors, Drill Press Chuck and Cylinder Combinations, 2- and 3-Jaw Finger and Compensating Chucks, Regulating Valve and Lubricator Assemblies, 3 or 4-Way Air Valves (hand or foot operated), Pressure Regulating Valves. Also Hydraulic Supercharged Power Units.

ANKER-HOLTH MFG. CO. 2735 Connors St., Port Huron, Mich.

Representatives in all Principal Cities 1720

When buying new lathes, specify "AIRGRIP" Chucks and Cylinders



You'll get peak production AT A PROFIT — with the *Uni-Matic**

Spindle speeds up to 5000 RPM. Completely automatic cycle, electronically controlled. Independent-motor-driven interchangeable tool slides ("Uni-Mats") you can position universally, tool universally.

These are just a hint of some of the revolutionary features you'll find in the Uni-Matic . . . for chucking and fixture work as small as 1″ and as large as 16″ diameter. It's the machine that brings automatic production within reach of every shop, no matter how large or how small the lots.

You'll get minimum machining costs as only you can with specialized automatic production. Best of all, when you change your design you don't change Uni-Matics. Just tailor the tooling to fit your new operation—it's only a few hours' job. The Uni-Matic is universally adaptable.

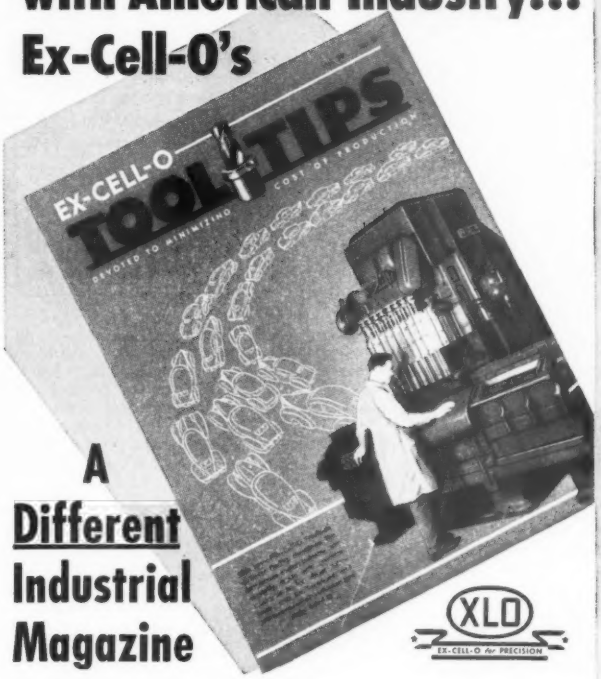
***UNI-MATIC**—Add this new name to your metal-turning dictionary—you'll be hearing a lot of it—wherever rising production costs are a factor. The *Uni-Matic* is Monarch's answer to this problem in the field of chucking and fixture work. For between-centers work it's the *Mona-Matic* for hand screw machine work, the *Speed-Matic*.

Get full details on these three new machines *now*—from your nearest Monarch representative—or write us direct.

The Monarch Machine Tool Co.
Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

IDENTIFIED
with American Industry... Ex-Cell-O's



A Different Industrial Magazine

Tool Tips, published regularly by Ex-Cell-O since 1925, is "devoted to minimizing the cost of production". Every issue contains a variety of useful hints to help you produce more accurate parts at lower unit cost.

Tool Tips is a free and an invaluable source of information to all who are interested in recent developments in metal working. If you are not now receiving *Tool Tips*, write Ex-Cell-O on your company letterhead today.

46—56

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

EX-CELL-O *makes*

- Standard and Special Multiple Way-Type Precision Boring Machines
- Multiple Drilling and other Special Purpose Machines
- Precision Thread Grinding Machines
- Precision Lapping Machines
- Broaches and Broach Sharpening Machines
- Continental Cutting Tools
- Tool Grinders
- Hydraulic Power Units
- Grinding Spindles
- Drill Jig Bushings
- Drill Chip Breakers
- Inspection Fixtures
- Fuel Injection Equipment
- R. R. Pins and Bushings
- Pure-Pak Paper Milk Bottle Machines
- Aircraft and Miscellaneous Production Parts

Here is a Point to Remember

You'll get many more accurate gagings with Elgin Sapphire

Specifications of the dial indicator point shown

- Oil hardened steel body
- Thread 4-48 x .187
- Body .250 O.A.L.
- Body 187 O.D.
- Sapphire point radius 187

$3.50 EACH

Discounts on quantities. Also available through your jobber.

Wear resistance of Elgin Sapphire is remarkable as proved in thousands of installations. Treated by exclusive process, Elgin Sapphire has a combination of hardness and toughness exceeding all known man-made materials. Dimensionally stable—unaffected by acids—non-porous—monocrystalline. Does not scratch work.

Nationwide reordering of Elgin Sapphire is equipping manufacturers with devices to improve product and save money. Contact points are another proved successful application. Other products are Sapphire Tipt Micrometers, Plug and Ring Gages, Standard Shapes, certain burnish-cutting tools, sizing tools, etc.

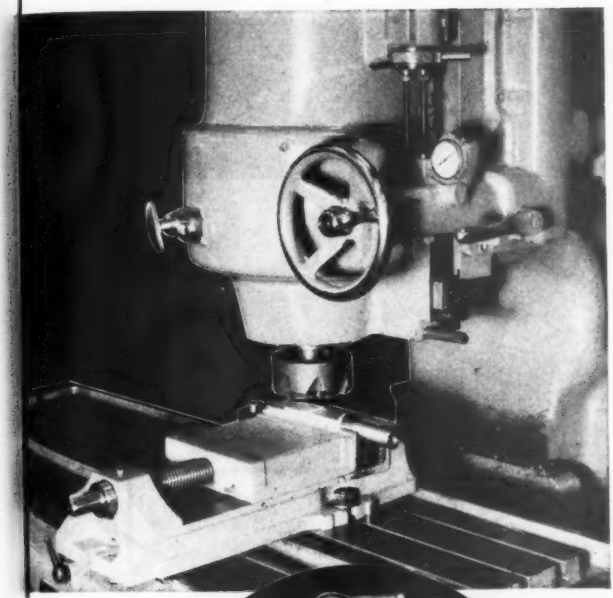
Other Elgin Sapphire contact points can be furnished to your specifications to fit any dial indicator. Shown here are a few representative shapes.

SAPPHIRE PRODUCTS DIVISION
Elgin National Watch Company, Aurora, Illinois
Representatives in cities from coast to coast

·ELGIN·
Sapphire Gages
DIMENSIONAL FIDELITY IN GAGING OPERATIONS

STAINLESS STEEL MILLING

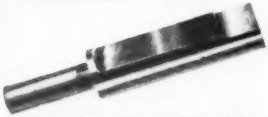
Made easy on a Kearney & Trecker CSM



THE JOB

Stainless steel is difficult to mill under almost any circumstances—but this super-powered CSM, equipped with the proper cutter literally "walked through" this job.

OPERATION: Rough Mill Stud
MATERIAL: Stainless Steel
CUTTER: 6" Dia.; 8 Tooth
TABLE FEED: 21 IPM
SURFACE SPEED: 346 SFM
DEPTH OF CUT: .441" (Max.)
FEED PER TOOTH: .020"
MILLING TIME: 26 Seconds



STAINLESS STEEL STUD

Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

• • •

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analyses of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

30 HP Plain CSM

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

BE READY FOR TOMORROW . . . WITH CSM's

A New Heavy Duty "PLUNGER" Clamp

by DE-STA-CO

No. 610

Plunger travel 1½"

Designed for locating and indexing, or comparable operations, of relatively heavy work. Can be switched from "Push" to "Pull" action in a few seconds. Plunger rod tapped to receive standard ⅜"-16 bolt. Overall length, (in "Push" position) 6¾". Weight 1½ lbs. Rust-resistant finish. De-Sta-Co clamps are the simplest means for securing work in jigs and fixtures through production and assembly.

This and other models described in detail in new De-Sta-Co Clamp Catalog No. 45. Send for copy.

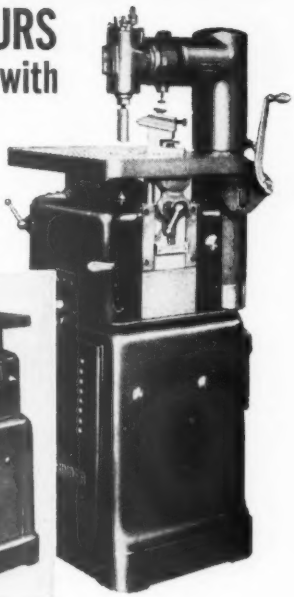
DETROIT STAMPING CO.

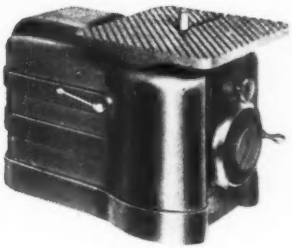
Established Over 30 Years

344 Midland Ave • Detroit 3, Mich.

SAVE TIME

GRINDING IRREGULAR CONTOURS
on hardened DIES, PUNCHES, PARTS, with
BOYAR-SCHULTZ
PROFILE GRINDERS





NO. 1 BENCH MODEL

A fast operating, precision Machine Tool for saving time in grinding difficult contours, and irregular shapes and profiles. In production as well as in tool and die work, it performs quickly, much of the tedious work formerly requiring hours of hand time.

Spindle speed of 20,000 R.P.M. with vertical oscillation assures rapid stock removal, even with wheels of small diameter. Accommodates wheels ⅛" to 1" diameter.

NO. 2 DUAL SPINDLE FLOOR MODEL

A precision Machine Tool, designed for larger and heavier work, grinding contours and irregular shapes. This dual spindle model is really two machines in one. Spindles are independently powered and operate at 10,000 R.P.M. with vertical oscillations. Stock removal is rapid with wheels as small as ½" diameter. Accommodates wheels ½" to 3" diameter.

NO. 2 SINGLE SPINDLE FLOOR MODEL

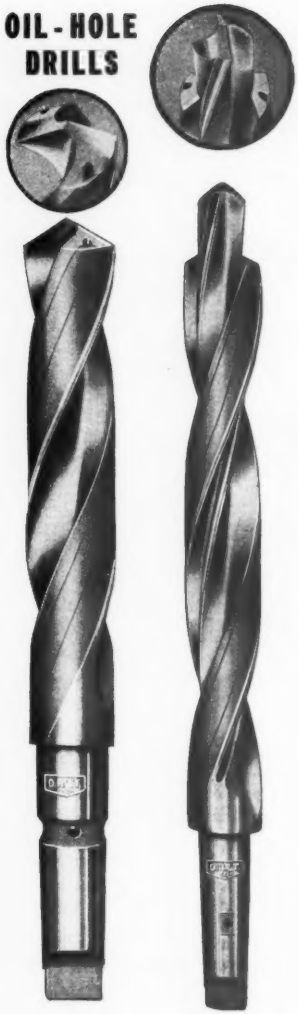
Exactly the same as the Dual Spindle Model except without the upper spindle, which may be added at any time if desired. A favorite Machine Tool in Tool and Die Shops.

WRITE FOR LITERATURE

BOYAR-SCHULTZ CORPORATION

2112 WALNUT STREET **CHICAGO 12, ILLINOIS**

OIL-HOLE DRILLS



Oil-Hole Drill

Subland or Dual Diameter Oil-Hole Drill

Straight or Taper Shank

NEED SUPERIOR QUALITY CUTTING TOOLS ?

PROMPT SERVICE!

*Oil hole drills
*Oil hole subland drills
Oil hole subland reamers
Subland drills
Subland reamers
Circularity relieved reamers
Circularity relieved end mills
Combination drill and reamer
Special drills and reamers
Line reamers
Core drills
Special Center drills
Special counterbores
Special countersinks
Flat and circular form tools
Special tools to your specifications

*Illustrated

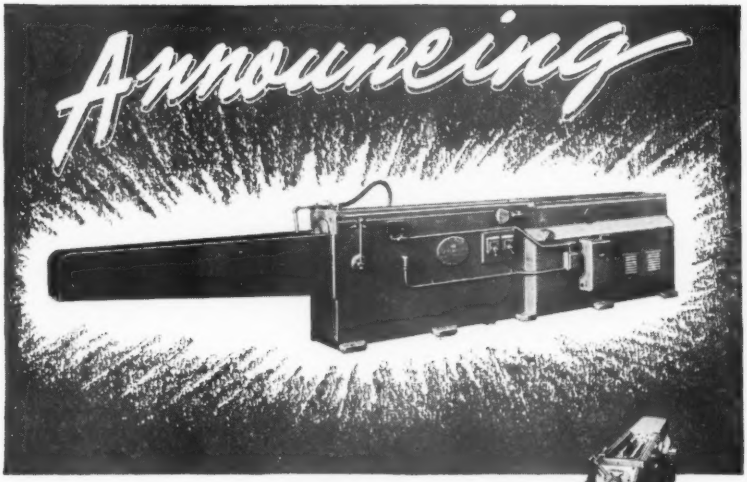
WIRE US YOUR REQUIREMENTS

As specialists in the manufacture of the above precision tools, we are in a position to give superior service, from the standpoint of both high quality and quick delivery.

Detroit Reamer & Tool Co.

2830 E. 7-Mile Road Detroit 12, Michigan

Write for QUOTATION



A NEW *American*

HORIZONTAL BROACHING MACHINE

For Heavy-Duty Internal and Surface Broaching

Engineered by *American*, this new horizontal broaching machine is designed to perform a wide variety of internal and surface broaching operations. It is particularly adapted to heavy-duty broaching involving the removal of a large amount of metal or broaching of large work pieces. As always, fast, accurate production with fine finish is possible.

This new *American* machine is made in two standard sizes, as shown in the table below:

	MODEL HD-15-66	MODEL HD-20-66
Pull Capacity	15 tons	20 tons
Stroke	66"	66"
Maximum Length of Broaching Tool	72"	72"

Write for complete details on these and other *American* broaching machines.

Left: Outer support table provides guide for broach rear pilot and automatic support jack for broach shank. Eliminates manual handling of broaching tool. Ball bearings on slide reduce wear and facilitate movement.

BROACHING TOOL INSTITUTE

American
BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

VERSATILE...

FOR A WIDE VARIETY OF PRECISION OPERATIONS

South Bend Precision Lathes offer special advantages to production shops, laboratories, and toolrooms that handle diversified work requiring a wide variety of exacting operations. They simplify change-over from one operation to another; help get new jobs into production quickly and economically. With their wide range of spindle speeds, they machine light metals, plastics, and steel with equal ease. A complete line of attachments and accessories enables South Bend Lathes to handle many operations which otherwise might require special fixtures or machinery. Take advantage of this versatility, coupled with South Bend precision, speed, ease of operation, and dependability, to increase the capacity and efficiency of your shop. South Bend Precision Lathes are made with 9", 10", 13", 14½", and 16" swings, collet capacities to 1", and bed lengths to 12'. Write for fully illustrated, complete Catalog 100-D.

WRITE FOR CATALOG

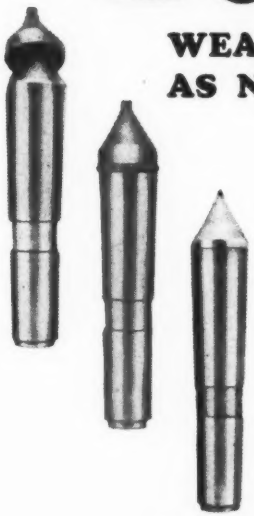
Catalog 100-D illustrates and describes all South Bend Lathes, attachments, and accessories, gives detailed specifications.

LATHE BUILDERS SINCE 1906

SOUTH BEND LATHE WORKS

432 EAST MADISON STREET • SOUTH BEND 22, INDIANA

YOUR WORN TOOL STEEL CENTERS *Can be Salvaged by using* COLMONOY



WEAR THREE TIMES AS LONG AS NEW, UNTIPPED CENTERS

If you want *real wear*, and less down time, apply new tip castings of Colmonoy No. 6 to your old centers, using Silver Solder or a low temperature brazing alloy.

We furnish the tips only, or apply, whichever you prefer. Prices are low, and results will astonish you. Why not give Colmonoy tipped centers a comparative test in your own shop? Write for Bulletin CT-1 for full information.

BRANCH OFFICES

New York, Buffalo, Chicago, Parsons, W. Va., Tulsa, Los Angeles, San Francisco and in Canada.

WRITE FOR LITERATURE

In addition to Bulletin CT-1, mentioned above, we shall be glad to send you our General Catalog No. 75, covering the complete line of Colmonoy Hard Facing Alloys, and illustrating typical applications.

WALL-COLMONOY CORP.

720 Fisher Bldg., Detroit 2, Michigan

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7″ SHAPER

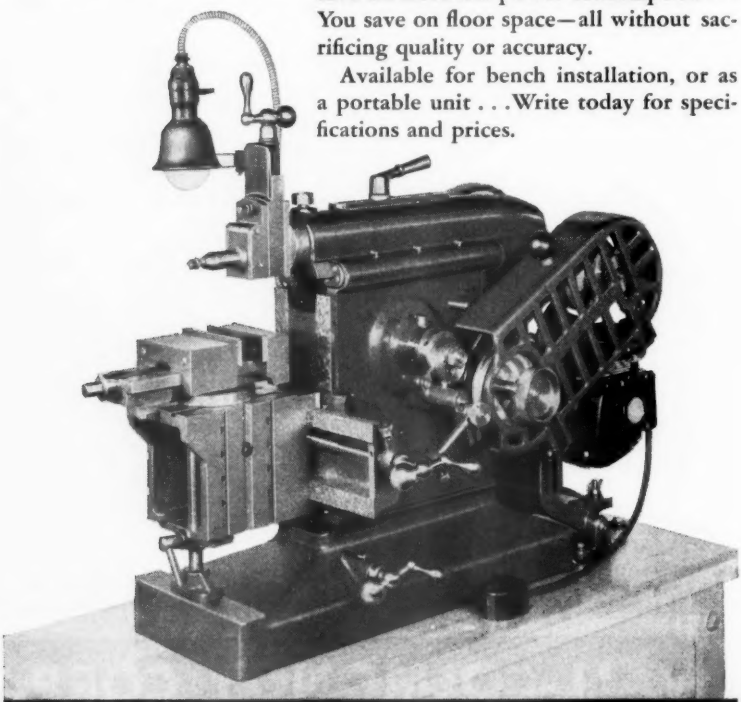
--A precision machine

meets postwar needs for accuracy, speed and economy

If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



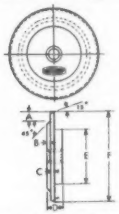
AMMCO 2100 COMMONWEALTH AVENUE NORTH CHICAGO, ILLINOIS

UP TO 500% **MASTERFORM** MASTERCASED LONGER LIFE

GROUND CIRCULAR CUT-OFF TOOLS

FOR BROWN AND SHARPE Screw Machines. Made in special-to-order and stock sizes (see below), ready for prompt shipments.

Masterform cut-off tools are made from specially selected high speed steel, carefully hardened and ground to a high polish. Mastercasing, the Masterform process of super-heat-treating, assures more production and 500% LONGER LIFE.



Designed to cut off .005 post center with 1/64 corner break.

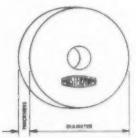
ORDER BY CAT. NO.	FOR USE ON MACHINE NO.	STOCK DIA.	A	B	C	D	E	F	PRICE EACH
00-30	00	1 16	.029	1 16	.030	1 4	1 27 64	1.750	4.00
00-40	00	1 8	.0635	1 16	.040	1 4	1 23 64	1.750	4.00
00-50	00	3 16	.0975	1 16	.050	1 4	1 19 64	1.750	4.00
00-60	00	1 4	.131	1 16	.060	1 4	1 19 64	1.750	4.00
00-80	00	3 8	.1985	1 16	.080	1 4	1 15 16	1.750	4.00
0-60	0	3 8	.1935	3 32	.060	5 16	1 5 8	2.250	4.50
0-80	0	1 2	.261	3 32	.080	5 16	1 5 8	2.250	4.50
0-90	0	5 8	.3265	3 32	.090	5 16	1 5 8	2.250	4.50
2-60	2	3 8	.1935	1 8	.060	3 8	2 7 32	3.000	5.60
2-90	2	5 8	.3265	1 8	.090	3 8	2 7 32	3.000	5.60
2-125	2	1	.5234	3 32	.125	3 8	1 29 32	3.000	5.60
2-156	2	1	.5318	3 32	.156	3 8	1 29 32	3.000	5.60

HIGH SPEED CIRCULAR TOOL BLANKS

FOR FORMING AND CUTTING-OFF TOOL USE

Made from a selected grade high speed steel, these tools are for use on circular cross slide tool posts of Brown & Sharpe automatic screw machines. These blanks are turned, drilled and tapped to fit tool post clamping screws. Blanks are either furnished soft as machined, or hardened and ground on two sides.

When ordering, please specify whether hard or soft blanks are desired, also diameter or machine number and thickness. Carried in stock for prompt shipment.



Tool blanks for other makes of screw machines can be furnished on special order.

FOR MACHINE NUMBER	DIA INCHES	THICKNESS INCHES	NET PRICES SOFT BLANKS 1-6	SOFT BLANKS 7-12	HARD BLANKS 1-6	HARD BLANKS 7-12
00,00G,19 AUTO	1 3/4	1/4 to 3/8 by 16ths	1.15	1.10	1.45	1.41
00,00G,19 AUTO	1 3/4	7/16 to 5/8 by 16ths	1.35	1.30	1.71	1.65
00,00G,19 AUTO	1 3/4	11/16 to 7/8 by 16ths	1.75	1.70	2.20	2.13
00,00G,19 AUTO	1 3/4	15/16 to 1 by 16ths	1.80	1.75	2.25	2.20
0 and 0G AUTO	2 1/4	1/4 to 3/8 by 16ths	1.30	1.25	1.67	1.61
0 and 0G AUTO	2 1/4	7/16 to 5/8 by 16ths	1.75	1.70	2.22	2.15
0 and 0G AUTO	2 1/4	11/16 to 7/8 by 16ths	2.15	2.10	2.75	2.68
0 and 0G AUTO	2 1/4	15/16 to 1 1/8 by 16ths	2.45	2.40	3.18	3.10
2 and 2G AUTO	3	1/4 to 3/8 by 16ths	1.80	1.75	2.24	2.17
2 and 2G AUTO	3	7/16 to 5/8 by 16ths	2.50	2.45	3.14	3.06
2 and 2G AUTO	3	11/16 to 7/8 by 16ths	3.15	3.10	4.00	3.92
2 and 2G AUTO	3	15/16 to 1 1/4 by 16ths	3.65	3.60	4.65	4.57

LARGER AND SPECIAL SIZES FURNISHED ON SPECIAL ORDER
UNLESS OTHERWISE SPECIFIED, SOFT BLANKS WILL BE FURNISHED

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Manufacturer and Designer of

Circular, Dovetail and Flat Forming Tools
Counterbores
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Recessing Tools
Reamers
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Cast Metal Alloy Tool Bits & Associated Products

ORDER FROM OUR FACTORY REPRESENTATIVE *(There's one near you)* OR FROM US

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VALVE OPENS BY FLEXING

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The Original Flexible Tip Blow Gun. Positive, snappy action. Flex the tip for a gentle puff or a steady stream of high velocity. Light weight, sturdy, streamlined, indestructible. Plated, hardened steel nose. You can drop it, throw it on the concrete floor, drag it around and through machinery without injury to blow-gun or machine. No Handles. No Levers. No Triggers. No Push-buttons. No Springs. No Packings. No Leaks. Nothing to break, clog, or get out of adjustment. Furnished in standard 1/4" pipe thread.

Price, $1.00 each

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HECKETHORN MFG. & SUPPLY CO. LITTLETON COLORADO

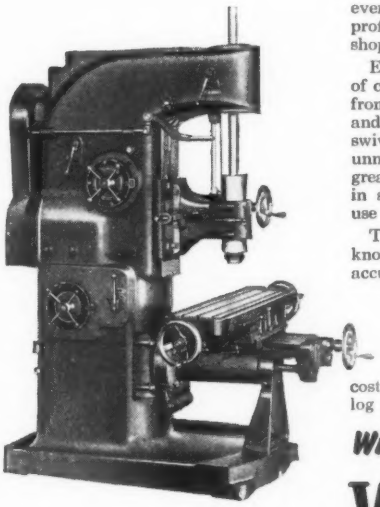
KEEP PRODUCTION UP...

KEEP COSTS DOWN

with KNIGHT MILLERS

By producing on a single miller, through ordinary methods, jobs that often require two or more machines, Knight Millers are proving every day their unusual value as a time-saving, profit-building investment in hundreds of plants, shops and toolrooms everywhere.

Eliminating special set-ups and the transfer of complicated milling, boring or shaping jobs from one machine to another, ups production and saves operator's time. Knight's tilting, swiveling table makes costly jigs and fixtures unnecessary for out-of-the-ordinary work and greatly increases working area. Wide variation in spindle feeds and speeds provide for the use of many various size cutters.



These features, combined with Knight's acknowledged advantages of speed, precision, accuracy, ruggedness, smooth operating simplicity and convenience mean faster, more efficient operation, uncommon economy in productive hours and a minimum of equipment expense.

How you can keep production up and costs down are all explained in Knight's Catalog which you may have for the asking.

Write for YOUR Copy Today!

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MACHINERY COMPANY

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  in handling dies and heavy fixtures; stacking barrels, boxes, etc.; loading and unloading trucks

Specifications

Type—D
Capacity—500 lbs.
Overall height—72"
Platform lift—54" above floor level, lowers to within 5" of floor
Baseframe—24" wide x 33" long
Platform—24" x 24", steel plate
Entire frame of machine of structural steel, electrically arc welded throughout
Basewheels—4" diameter, iron wheels
Crank up and down hoist unit
Two swivel casters and two stationary wheels with push bar furnished
Painted olive green finish
Weight—250 lbs. (approx.)

Heavier capacities up to 5,000 lbs. also available. Write for details.

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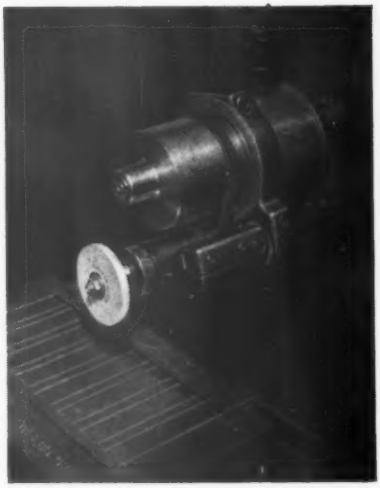
Now you can do "impossible" surface grinding jobs with the BLITZREV

Attachable to a surface grinder in a few minutes, the BLITZREV operates small wheels at high speed. With a wheel as small as 2" diameter, grinding all over the magnetic chuck is possible. The attachment can be adjusted forward and backward to make the wheel reach beyond the chuck. It can also be swung around to any desired degree.

By making every part of the work accessible to small wheels, the BLITZREV handles jobs which would otherwise be impossible on a surface grinder. That's why users say the attachment is a grinding room "must."

The photograph shows how a long pulley fits the regular mount of the surface grinder. A flat belt around this pulley engages either of the two pulleys on the BLITZREV spindle to operate at 10,000 or 15,000 r.p.m., giving surface speed equal to or greater than that of large wheels on the regular mount. Seven standard quills are furnished, taking wheels from small 1/8" shank-



mounted to any other known shape or size up to 3" diameter.

Get all the facts by writing, wiring, or mailing the coupon. Do it now while the subject is on your mind.

BLITZREV
GRINDING ATTACHMENT
(PATENTED)

D & S
MODEL CO.

3114-56 E. 3rd St.
DAYTON 3, OHIO

D & S MODEL CO.
3114-56 E. 3rd St., Dayton 3, Ohio

Send complete information about the BLITZREV Surface Grinder Attachment.

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Individual

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Company

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Street Address

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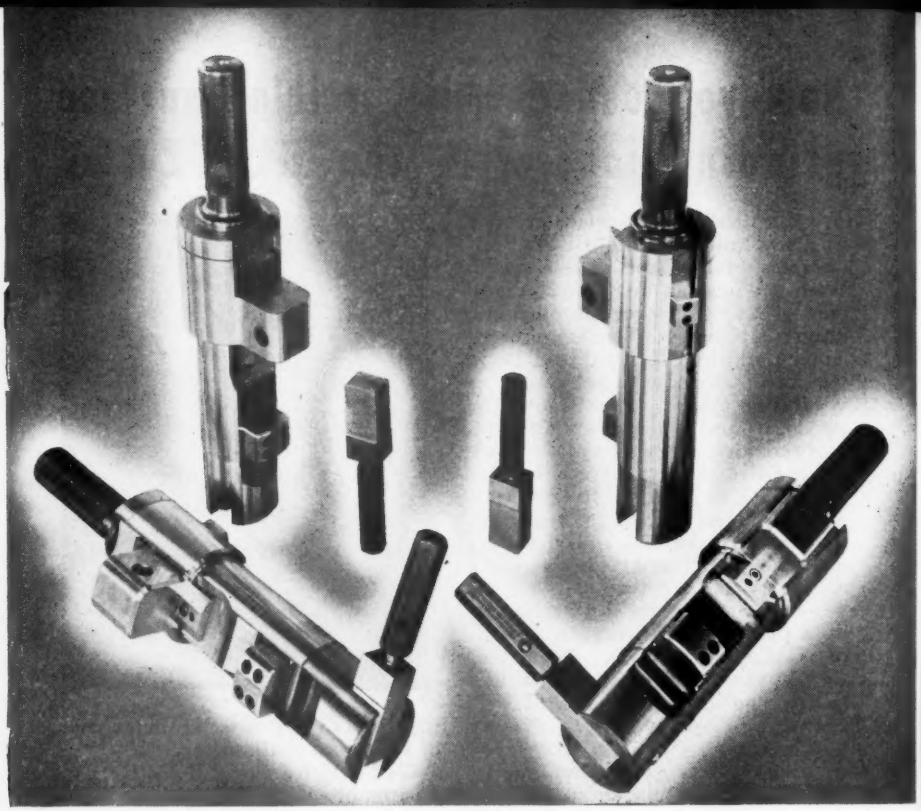
City Zone State



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Tools and Gages maintains to serve you the most modern machines and tools to produce your special tools, gages and ground threaded parts.

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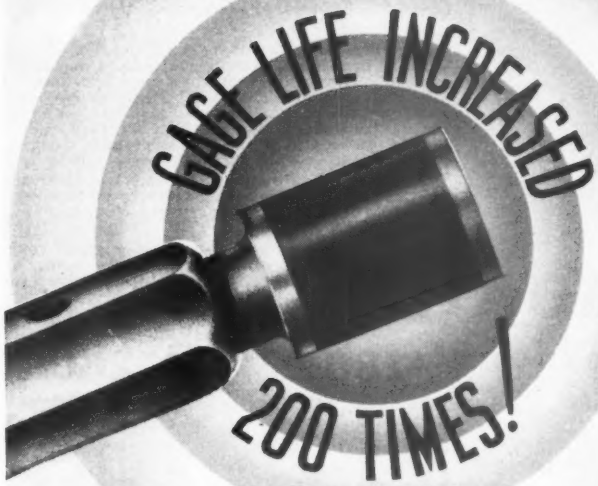

The fact that NORBIDE Gages will outlast conventional types of measuring devices 200 times and more is explained by the extreme hardness of Norton Boron Carbide (trade-marked NORBIDE)— the hardest material made by man. In addition to their great resistance to wear, NORBIDE Gages will not pick up lint nor become charged with particles of metal. They are lighter than aluminum. You can obtain NORBIDE Gages from your regular gage manufacturer, or for further information write to:

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ELECTRIC HEAT • • • • •
TREATING FURNACES • •
with automatic control • •

These furnaces will answer your heat treating problems for hardening, drawing, tempering and annealing or normalizing of dies, punches, gage and fixture parts —in fact anything that will fit within our range of muffle sizes. They are quiet and efficient and do not use up the oxygen in your heat treating room. The Lucifer Automatic Heat Control permits stepless control anywhere within its heat range—up to 2000° F.

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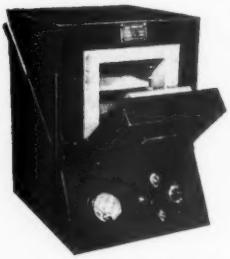
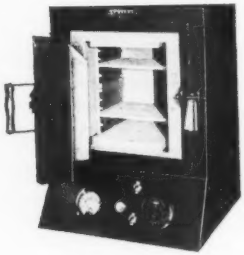
$112.00

- Interior size—Model 7051 5½" x 5½" x 6"
- Exterior size— 15" x 15" x 17"
- Operation— 110 V.A.C. only
- Rating—1.2 K.W.
- Ship. Wt.— Approx. 85 lbs.



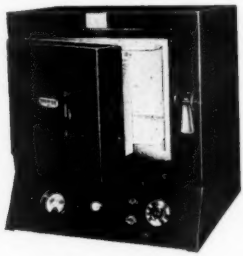
$188.00

- Interior size—Model 7053 8" x 8" x 10"
- Exterior size— 18" x 20" x 24"
- Operation—110 V.A.C. or 220 V.A.C.
- Rating—3 K.W.
- Ship. Wt.— Approx. 225 lbs.



$260.00

- Interior size—Model 7052 12" x 12" x 10"
- Exterior size— 22" x 22" x 24"
- Operation—220 V.A.C.
- Rating—4.8 K.W.
- Ship. Wt.— Approx. 350 lbs.



New York—Connecticut—Northern Jersey: Lafayette Tool & Supply Co., 128 Lafayette St., New York 13, N. Y.

Rhode Island—Massachusetts: H. Leach Machinery Co., 387 Charles St., Providence 4, R. I.

Eastern Pennsylvania—Southern Jersey: Wilson Steel & Tool Co., Commercial Trust Bldg., Philadelphia 2, Pa.

California: Reagan Company, 6409 Santa Fe Ave., Huntington Park, Calif.

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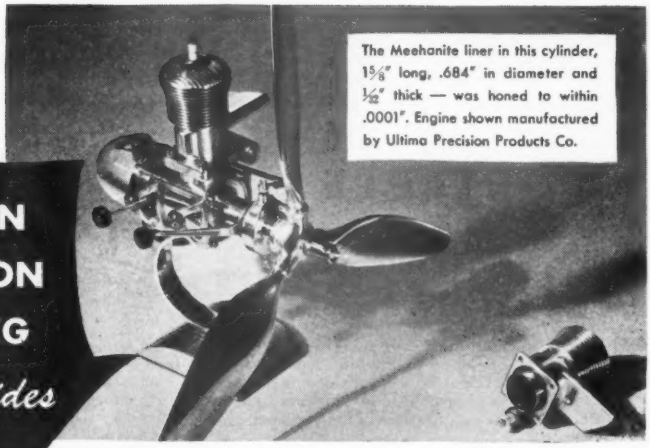

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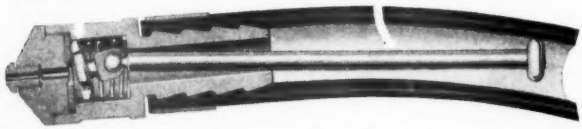

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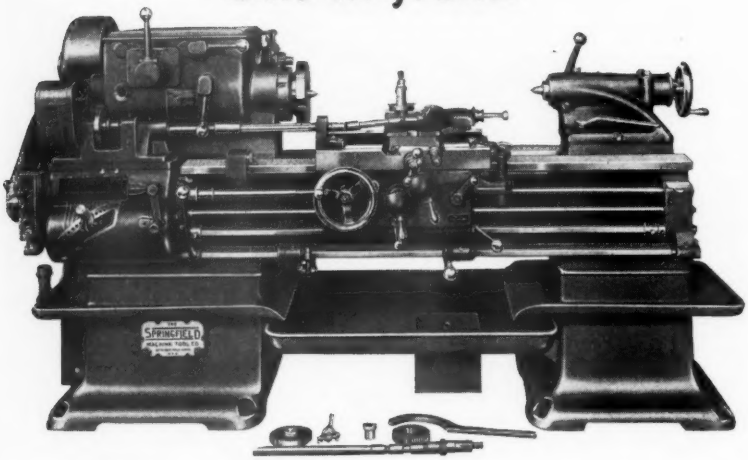

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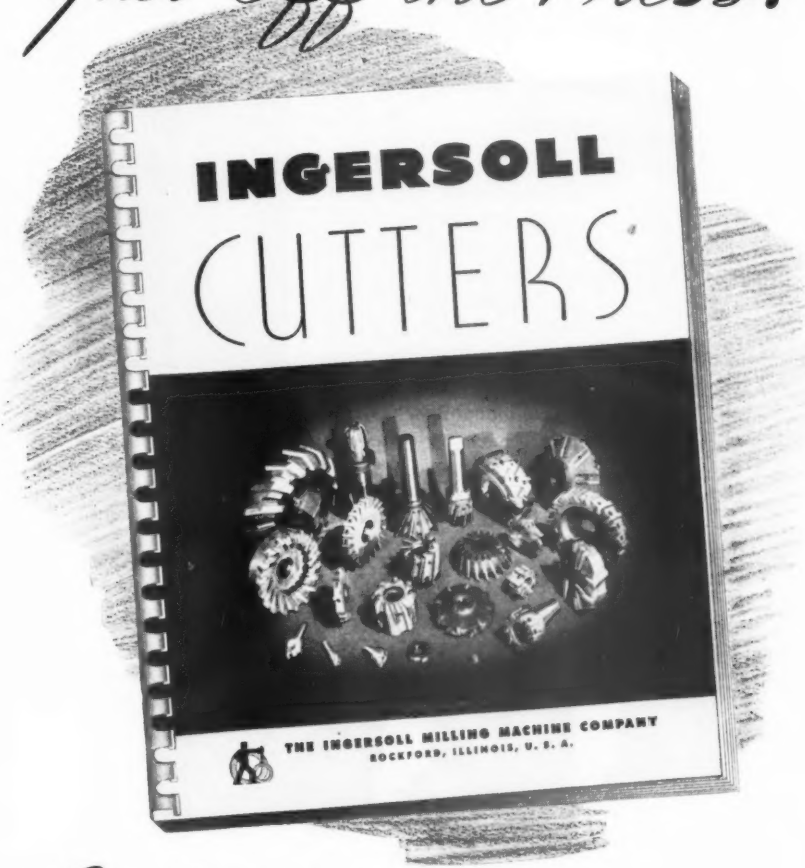

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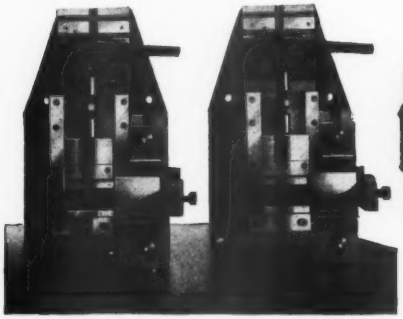

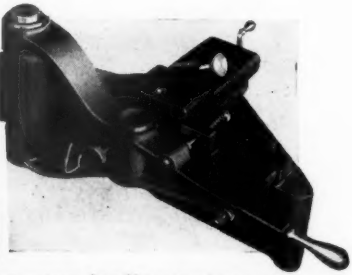

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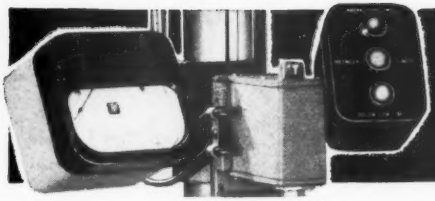

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PRECISION MEASURING INSTRUMENTS

other peoples' money

In the financial world the small investor, in the aggregate, is a very important factor. So much so, that innumerable safeguards have come, by trial and error, to be erected in his favor. The compulsory filing of corporate statements as a matter of public record; the many regulations of the Securities and Exchange Commission governing the advertising and sale of securities; the coordinating of margin requirements in stock buying with inflationary trends; the prescribing of brokerage commissions and fees; all can be construed as benefiting the small investor.

Putting it the other way around, these rules and regulations govern the conduct of those who are entrusted with other peoples' money.

In the field of government there likewise is the small investor, i.e., the individual taxpayer. He is investing his tax money in the United States as a going concern. His dividends are the benefits that accrue from the spending of his tax money. Here again, we have regulatory checks and balances. Taxes are levied and appropriations authorized by the legislative bodies, representatives of the people. Appropriations carry legal definitions of how the taxpayers' money is to be spent, and the public officials entrusted with this money are rigidly bound by those limitations.

This legal administration of public funds is another example of machinery set up to safeguard other peoples' money.

Most recently, a realization has swept over the country of the accumulation of additional vast sums of other peoples' money which are not safeguarded by the modicum of legal checks and balances necessary to insure, to the real owners, security in the administration and allocation of their money.

The rank and file member of a labor union invests a portion of his livelihood, i.e., fees, dues and assessments, in the growth and material well-being of his union. For this he is entitled to realize as dividends those benefits that accrue from wisely conceived and conducted union functions. Although his investment is small, he is, none the less, an investor of money.

Thereby, however, millions of other peoples' dollars become available to a labor union head to allocate and spend for political or any other purposes that might well be detrimental to, and at variance with, the inarticulate desires of the membership as a whole. This can be done on his own impulse or with the sanction of a hand-picked, rubber stamping executive board.

Is it in any way fair, just and reasonable that these particular funds of other peoples' money be subject to any less safeguarding as to responsible custodianship than are any other funds of other peoples' money? We think not!

E. Willard Cunningham

editor

EXPERIENCES WITH*

by M. E. Feldstein**

General Superintendent, Indirect Mfg. Depts.

Delco Products Division, General Motors Corp.

Dayton, Ohio

Carbide-tipped cutting tools for milling, drilling, boring, and turning had been in use at Delco Products Division of General Motors Corporation plant at Dayton, Ohio, for some years before the recent war. However, their use was confined mostly to cast iron applications for automotive shock absorbers and electric motors.

With the advent of the war, the necessity arose of achieving greater production with fewer people, fewer pieces of equipment, and with the man-hours necessary for the schedule rapidly becoming in excess of 24 hours per day per man. One of the major projects was machining landing-gear struts for aircraft, with steels of aircraft quality, machined both in the normalized and hardened state, with machining conditions running as high as 42 Rockwell C.

Here, in particular, the need of greater production became manifest. However, delivery of equipment was becoming extremely critical, schedules were going many times higher than had been anticipated, and an insufficiency of available floor space added to the difficulties. As a result of these production handicaps it was decided to attempt a solution to the problem of getting more production per machine-hour, by studying all aspects of carbide tool application, doing the job logically, systematically, and practically. The approach was resolved into such brackets as (1) tool engineering, (2) tool follow-up and processing, (3) tool manufacture, (4) tool maintenance.

Tool Engineering and Follow-Up

To implement the program, several of the tool-engineering-department staff were selected who had fundamental experience in feed, speed, horsepower application, knowledge of equipment, and a thorough understanding of the product to be manufactured. To one of these engineers was assigned a group of practical artisans termed "tool process men", whose particular duty it was to analyze the type of tool required to do a given job to the best advantage, and to whom were delegated special individual operations to process to the ultimate degree. Shortly after they had been chosen and indoctrinated by the engineering group with what knowledge had been accumulated over a period of years prior to the war, they were sent to the Carboloy Company for additional training. When sufficient facility had been acquired,

*Contributed by the Research Committee on Metal Cutting Data and Bibliography and presented at the Fall Meeting of the Cincinnati Section, Cincinnati, Ohio, Oct. 2-3, 1945, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Presented here by permission of the Society.

ACKNOWLEDGMENT

**The author wishes to thank the following members of his staff for their assistance in preparing this paper: W. S. Meshew, tool engineer; A. Schako, superintendent of supplies; H. F. Schwinn, superintendent of Tool Division; C. F. Wittlinger, superintendent of process; H. L. Wabler, process follow-up.

CARBIDE-TIPPED TOOLS

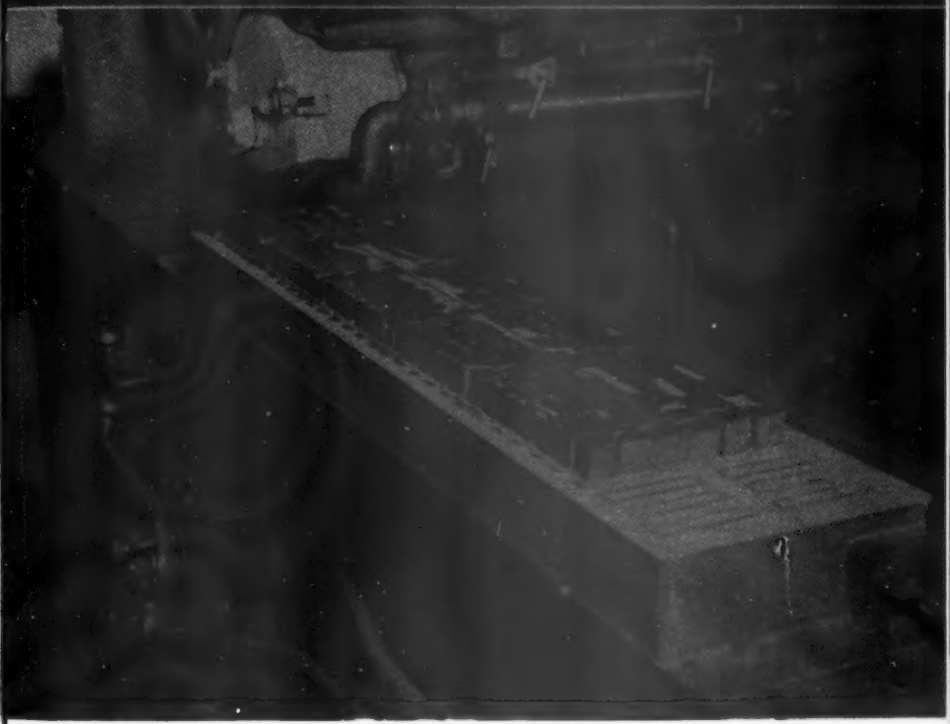


Fig. 1. Surface-grinding tool shanks.

shift assignments were made so that representation on the job was placed on the basis of 24 hours a day. These men were thus constantly available to the supervision of the manufacturing departments for help and advice as to the most practical method of doing the operations involved.

After the tool engineer responsible for a given project had estimated the ultimate production that might be procured on specific operations, tool process men were assigned to those operations and it was their duty to go out and get production.

Not only were these men capable of

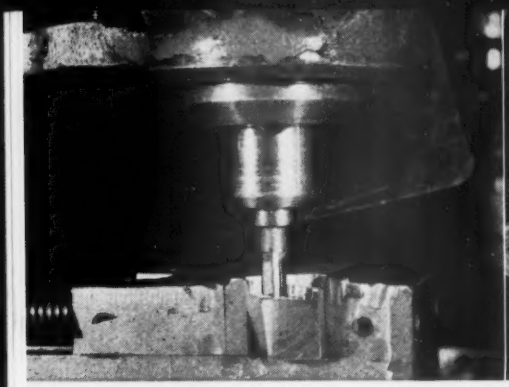


Fig. 2. Milling pocket for carbide tip.

Fig. 3. Induction-brazing carbide tips on variable-speed rotary table.

determining the basic cutter designs, but also of manufacturing the most practical cutters for the specific job and giving them a thorough tryout.

However, it was not long before we discovered that it would be almost impossible to get the number of cutting tools required to maintain production. Steps were therefore taken to set up a department devoted entirely to the manufacture of carbide-tipped tools.

Tool Manufacturing

During the period of peak production, the tool manufacturing department made as high as 20,000 tools per month. This may sound as though tools were being misused. However, when one looks at the schedule of almost 1600 sets of landing gears per month, produced in a plant operating around the clock 7 days a week, with each set consisting of two main legs and one nose leg for such airplanes as B-24 Liberator, B-25 Mitchell, B-26 Martin, TBY for Consolidated Vultee, A-26 Douglas Invader, P-51-H Mustang, and the FR-1 Ryan, it will be realized what a tremendous number of parts were involved which necessitated the use of cutting tools.

In the process of manufacturing cutting tools, practically all of our last issue of tools were made with cast Meehanite shanks. The shanks were placed on the surface grinder, Fig. 1, in lots of 100, and two surfaces were ground parallel. The pocket for the tool was cast and merely touched up by milling, Fig. 2, with a zero-rake milling cutter running in the neighborhood of 1200 sfpm. All the tips were brazed on by induction heating, Fig. 3; the equipment consisting of a continuous rotary turntable on which the tools were placed and passed between induction coils for brazing. The angles were then ground on the tool, Fig. 4, to a specified tool engineering drawing.

A carefully kept cost record showed that we were able to make tools at anywhere from 30 to 60 percent less cost than we were able to buy them, because we knew our problem better than the outside tool manufacturer. These tools gave much longer life than those purchased, which is no reflection on the ability of the outside tool concern to make good tools, since we were able to incorporate certain refinements over which the outside purveyor had no control.

Tool Maintenance

The manufacture of the tools and their maintenance were carefully controlled. After a tool design was developed, a standard sheet was drawn up containing all the data pertinent to its application. This drawing was issued by the tool engineering division to the toolmaking department, to the tool maintenance department, and to the general foreman of the department in which the tool was to be used. When tools were returned for regrinding, they were reground to the original drawing. This eliminated the bad features of job setters changing angles to suit their own

Fig. 4. Grinding carbide-tipped lathe tool.

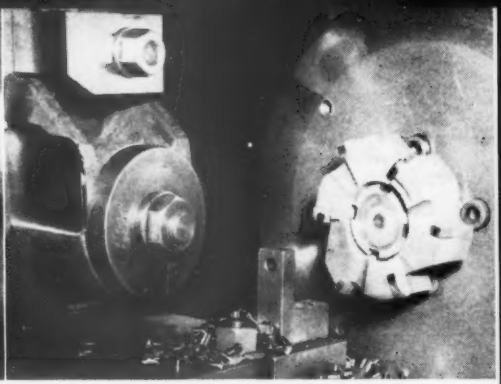


Fig. 5. Actual installation of the Fig. 8 setup in milling forging for landing gear.

particular ideas. No grinding wheels were allowed on the job. All carbide tools had to be returned to a tool crib, thence to the tool grinding room, which was separate and distinct from the tool manufacturing department. Here the tools were reground to the original drawing and then returned to the proper production department.

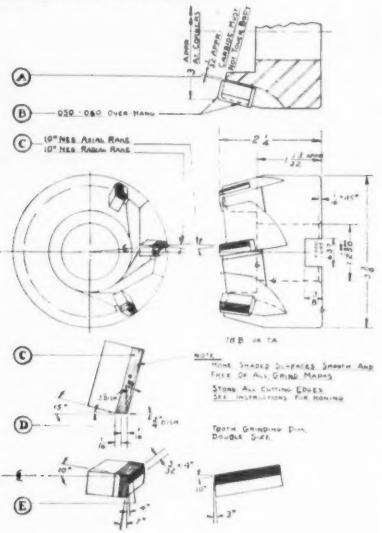
Tool changes were made only upon receipt of an official "tool change request", signed by authorized individuals. At that time, all old prints applying to the tool in question were removed and destroyed, and new ones placed in the files.

A knowledge of the correct grinding procedure for steel-cutting carbides is of prime importance. Improper grinding methods produce weaknesses in carbide tips that are not inherent in the material; cracks and checks are formed in the carbide which can be avoided if the proper care is taken in grinding. After all finished cutting faces are ground, we add a hand lapping operation in order to give all the cutting edges a dulling effect by using a 320 x 400-grit diamond vitrified honing stone.

All cutters must pass a rigid inspection before being placed in use. Before and after grinding, carbide cutting tools are given the Zyglo magnaflux treatment to detect whether any tips require replacement due to cracks which may have formed in brazing or grinding. All single point turning and boring tools are rough- and finish-ground by hand.

Fig. 6. Removing chips from cutter teeth using scratch brush.

Fig. 7. Typical Delco Products Cutter Design Standard Sheet.



General Engineering

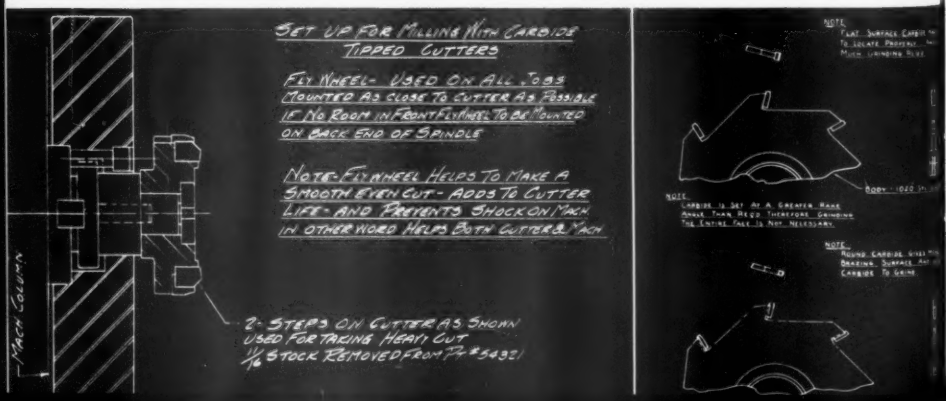
It has been our experience that the greatest mistake made by users of carbide-tipped tools is a tendency to think of them in terms of high speed steel tool bits. This immediately leads into the trap of making tools with shanks which are too small. It is our practice to use the largest possible shank that we can get into the toolholder or machine. In turning, we never use less than a ⅝" square, and preferably a ¾" square. In boring, ⅝" round is preferred. However, there are cases where we have had to go to a ½" round.

The next pitfall is failure to make toolholders rigid enough. Unless the tool is supported rigidly, and the tool block made massive enough and fastened rigidly to the machine member, tool life will be decreased tremendously, the type of finish will be unsatisfactory, and size will not be held.

As an example, we were called in about a year ago to look at an operation for turning and boring an aircraft part at another plant. The part was a forging made from X-4130 quality steel, normalized, hardened, and drawn to about 33 Rockwell C. The forging had a great amount of material to be removed. The machine tool builder designed the tools in the manner just noted, i. e., too small and not rigid. The grade of carbide tip was not correct, in our opinion, and the user of the equipment was not too familiar with carbide-tipped tools. In their zeal to get the job into production, we found aluminum grade, cast iron grade, and steel cutting grade carbides being used promiscuously on the machine. We were asked to help them out. One of the first things we did was to throw away the toolholders. The next step was to design and make the heaviest tool bit that it was possible to get on the machine, which was a six spindle chucking machine. It was also determined

Fig. 8. Setup for milling with carbide, showing flywheel.

Fig. 9. Illustrating method of attaching carbides to narrow cutters to reduce grinding time and eliminate brazing fixtures.


SET UP FOR MILLING WITH CARBIDE TIPPED CUTTERS
FLY WHEEL- USED ON ALL JOBS MOUNTED AS CLOSE TO CUTTER AS POSSIBLE IF NO ROOM IN FRONT FLYWHEEL TO BE MOUNTED ON BACK END OF SPINDLE
NOTE-FLYWHEEL HELPS TO MAKE A SMOOTH EVEN CUT- ADDS TO CUTTER LIFE- AND PREVENTS SHOCK ON MACH. IN OTHER WORD HELPS BOTH CUTTER & MACH.
MACH COLUMN
2- STEPS ON CUTTER AS SHOWN USED FOR TAKING HEAVY CUT 1/16 STOCK REMOVED FROM PC #5492

that with the correct feeds and speeds within the horsepower rating of the equipment, it was possible to get 125 to 150 pieces per hr. At the time our tool engineers were called in, they were getting only 150 pieces in 8 hr, because of tool trouble and the associated troubles that go along with such a job. Ten days after we started, they were getting 150 pieces per hr, and where four machines had been required, three were made idle.

Milling With Carbide-Tipped Cutters

The essentials of good milling with carbide-tipped cutters are fundamentally the same as the essentials of good milling with high speed steel cutters, omitting the use of the proper coolant which is not desirable in carbide-milling:

1. Machine must be in good condition:
   (a) Gibs should be properly adjusted.
   (b) Backlash in the feed mechanism should be reduced to a minimum.
   (c) Drive belts should be checked to see that a full set is on each machine, and that they are properly adjusted and in good condition. The clutch, if one exists, should also be checked.
2. The work-holding fixture must hold the work rigid and must be securely fastened to table.
3. The correct cutters must be selected for the job.
4. Proper feeds and speeds should be selected and used.

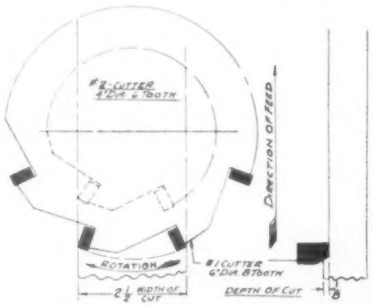
Although the items mentioned are essential for both conventional and carbide-milling, they are far more exacting when milling with carbide, as the machine must operate at higher speeds, greater feeds, and must work more nearly at its maximum capacity.

The work-holding fixture must hold the work more rigidly. Yet, due to the increased feed, which means a shorter milling time, the fixture should be so designed as to cut the loading time to a minimum, insuring more pieces per hour.

Quite often the existing milling machine requires the use of a flywheel to aid in getting a smooth flow of power to

(CONTINUED ON PAGE 142)

Fig. 10. The ideal job for carbide-milling. (Part to be milled, SAE 1020, Brinell 190; recommended surface speed, 675 rpm minimum; maximum spindle speed of machine, 450 rpm; correct diameter cutter, 675.452 x 0.262", 5.7" dia. use 6").


#2 CUTTER
4 DIA 4 TOOTH
DIRECTION OF FEED
ROTATION
#1 CUTTER
6 DIA 8 TOOTH
2½ WIDTH OF CUT
DEPTH OF CUT
AN IDEAL JOB
MACH CAPACITY - 15 HP - 450 RPM SPL 20" MAX FEED
MATERIAL - 1020 SOFT - RECOMMENDED CUTTING SPD 675 FPM
NOTE
THIS WOULD REQUIRE A 6 DIA CUTTER FOR PROPER CUTTING SPEED
8 TEETH TO MAINTAIN 1 TO 2 TEETH IN CONTACT FOR A SMOOTH CUT
NOTE
CUTTER #2 - 4 DIA 4 TOOTH WOULD NOT HAVE ENOUGH SURFACE SPEED FOR GOOD MILLING ON 1020 STL

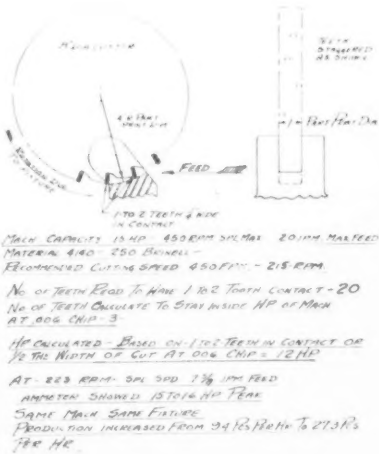

FEED
1 TO 2 TEETH IN CONTACT
MACH CAPACITY 15 HP - 450 RPM SPL MAX 20 IPM MAX FEED
MATERIAL 4140 - 250 BRINELL -
RECOMMENDED CUTTING SPEED 450 FPM - 215 RPM
No. OF TEETH REQD TO HAVE 1 TO 2 TOOTH CONTACT - 20
No. OF TEETH CALCULATE TO STAY INSIDE HP OF MACH AT .006 CHIP - 3
HP CALCULATED - BASED ON 1 TO 2 TEETH IN CONTACT OR ⅛ THE WIDTH OF CUT AT .006 CHIP = 12 HP
AT - 223 RPM - SPL SPD 7⅜ IPM FEED
AMPMETER SHOWED 15 TO 16 HP PEAK
SAME MACH SAME FIXTURE
PRODUCTION INCREASED FROM 94 PCS PER HR TO 271 PCS PER HR

Fig. 11. Avoiding shortcomings of existing equipment by staggering teeth.

Duplicating With The Keller From

Gypsum Cement Models

by E. H. Schleede
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and

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The Keller Automatic Tool Room Machine is a specially designed profile milling machine. It is equipped with a tracer mechanism which controls the relative movements of the cutter and the work.

The master model or profile template and the work are mounted in a vertical plane, the work being in the lower position as is shown in Figure 7.

The axes of the tracer mechanism and the cutter spindle are horizontal. The tracer is mounted on a bracket above the cutter and the distance between the two is adjusted to conform to the overall size of the job to be done. Once adjusted, the tracer and cutter move in unison; the tracer following the profile or shape of the master model and the cutter imparting the same profile or shape to the work. The electrical controls as actuated by the tracer are so sensitive and positive that the shape produced by the cutter is a precise reproduction of the model.

The Keller is capable of two types of operation by tracer control: first, profile tracer; and second, automatic tracer.

The profile tracer controls and guides only the vertical and horizontal movements of the machine. The cutter is set at a fixed depth and the tracer point maintains continuous contact with the master while passing around its profile. For this type of profiling, a thin metal template (either male or female) is ordinarily used as the master. The back of the tracer carries four contact points controlling the up, down, right and left movements. A very slight change in side pressure of the tracer point against the master is sufficient to break one of these contacts and to make another. This changes the direction of travel by energizing or de-energizing the magnetic ciutches which activate the four movements (up, down, right and left) of the cutter relative to the work. The sensitivity of the tracer is such that a less than .001" change in position of its point as it bears against the master will vary the direction of the machine travel. This sensitivity is independent of the size of the cutter, depth of cut and hardness of material being worked.

In profile tracing the operator guides the tracer point toward the master and determines the general direction of outline to be followed. Manual operation of a control at the rear of the tracer is necessary to establish the general bias or orientation of machine travel within each 90° of the master outline.

The second type of Keller tracer con-

trol is the automatic tracer which is used for three-dimensional work. The machine controls are set to cause the tracer to cover automatically the entire surface of the master by a succession of parallel passes, either horizontal or vertical. The desired feed is automatic at the end of each pass, and adjustable reversing dogs or a manual reversing switch govern the length of the travel.

When the point of the automatic tracer is not in contact with the model the machine is caused to travel in. Once contact is established and as the tracer makes its lateral passes over the model, the varying contours of the model create varying degrees of pressure on the tracer point causing the machine to travel in and out. The automatic tracer responds to either axial or side pressure and by means of interlocking relays it eliminates the horizontal or vertical motion while travelling either in or out. Thus the complete form of the model, regardless of how abrupt or steep its contours, is accurately reproduced.

Masters or models for duplicating with the Keller may be made of a wide variety of materials. For profiling, thin sheet metal templates are frequently used. Solid (three-dimensional) masters may be steel (a worn or damaged mold or die might sometimes be used), wood, cement, a cast, carved or machined and finished model of molded material or gypsum cement, a material now growing in favor.

When the Keller machine was first introduced, wood models were used extensively but their deficiencies resulted in a search for more suitable model materials. Two important requirements of these materials were dimensional stability, which would be unaffected by climatic changes, and a sufficient hardness to support the tracer point, as any indentations made in the model would be duplicated in the die. It was also desirable that the material be adaptable to the easy production of either a negative or a positive.

One gypsum cement in particular, Hydrocal A-11, was developed to meet these requirements by the United States Gypsum Company in close cooperation with the users and producers of the Keller machine. This cement gave a model

Figure 1

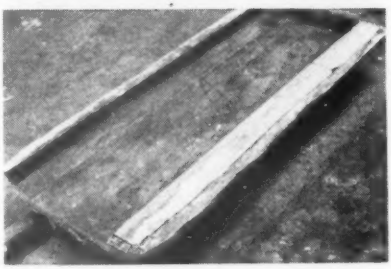


Figure 2

of close accuracy and of sufficient strength and hardness to meet all requirements. It has been a standard material for Keller models for over ten years and is used very extensively for that purpose by automotive plants.

A newer product, Hydrocal B-11, which has all the salient properties of Hydrocal A-11 plus better working qualities, has been developed. Hydrocal B-11 was used for the models in this application.

A Chicago tool manufacturer, working on refrigerator door dies, experienced considerable difficulty in making mahogany patterns sufficiently accurate for duplicating machine masters. The builders of the Keller (Pratt & Whitney Company) advised that gypsum cements be tried.

The overall dimensions of the models were specified as 59.928″ in length, and 28.928″ in width with a tolerance of ±0.005″. The wood pattern maker who made the mahogany model did not be-

Figure 4

lieve gypsum cements could be utilized for patterns having such close tolerances. However, the gypsum cement models, when checked for height variance with an indicating micrometer, were found to be within 0.001" overall. Checking for overall width and length with a vernier caliper, they were within 0.002" variance.

The job began with a set of templates cut to the contours required by the blueprint. These were needed to produce the stock mouldings which were assembled to make the master pattern. A separate template was required for each change in profile of the door.

One was made to conform to the contour of the door proper, Fig. 1. This contour was the same on all four sides thus it was only necessary to extend this template to the center line of the width of the door. Another template was necessary for the hinge boss profile, another for the latch boss profile, and a forth template for the corner radii.

A moulding of Pattern Shop Hydrocal was run to produce enough stock for one side of the door. A mold was then produced by casting over the "positive" or moulding produced by the template shown in Fig. 1. Since no draft was allowed at the center, a lateral loose piece was necessary. A mold, Fig. 2, was produced with Hydrocal B-11 and reinforced with long hemp fiber. The mold was sealed with shellac and a parting agent was employed to facilitate separation. Using Pattern Shop Hydrocal, enough stock was cast out of this mold for the other side and both ends of the door. Then a moulding was run to produce profiled stock for both hinge bosses and the same procedure was followed for the latch boss and the four corner radii.

The next step was to assemble the various parts into their respective posi-

Figure 3

tions. The mouldings were mitered roughly; the hinge bosses, latch boss, and corner radii were cut to length and placed into position. The joints were filled in and blended with new mixes of gypsum cement. The corners were blended by carving them to the proper contour of the door moulding. The main panel was then blended by planing and scraping to obliterate the direct miter and thus produce a smooth center panel. The model, Fig. 3, was given several coats of shellac. It was then ready to have the die model (the Keller female die) cast from it.

The die model or pattern, Fig. 4, was cast of Hydrocal B-11 mixed with warm (120° F) water. Minimum expansion being required in making this model, warm water was used to further reduce the naturally low expansion of Hydrocal B-11. This model was reinforced with long, hemp fiber bats dipped into the gypsum cement mix. Fig. 5 is a rear view of the model seen in Fig. 4, showing parallel bars tied into place. These bars were secured to the model with fiber which had been dipped in a gypsum cement mix. They are positioned so that the model can be properly placed and clamped to the angle plate of the Keller machine.

The die model was then sealed with several coats of shellac and a separating medium applied.

The punch model (the Keller male die) was then produced by casting into the die model. The punch, Fig. 6, was cast of Hydrocal B-11, again using 120° F mixing water. Shellac is sometimes used on the model surfaces but most users prefer to rub graphite over the face of the punch to permit the stylus to slide more readily. The models, checked with a vernier caliper, were within the specified dimensions and were then ready to use.

The partially Kellered punch is shown on the Keller machine in Fig. 7. The tape on the punch model serves as a guide for the operator, since this job was larger than the capacity of the machine and it was necessary to duplicate in four steps.

The methods described for producing these particular dies are basic. By modifying the details of the procedure, these methods can be adapted to the production of a wide variety of shapes and sizes of Keller models.

Note: In producing patterns and models with gypsum cements, it is important to select the proper type for each phase of the work. The physical properties of the three gypsum cements

Figure 5 (above) Figure 6 (below)

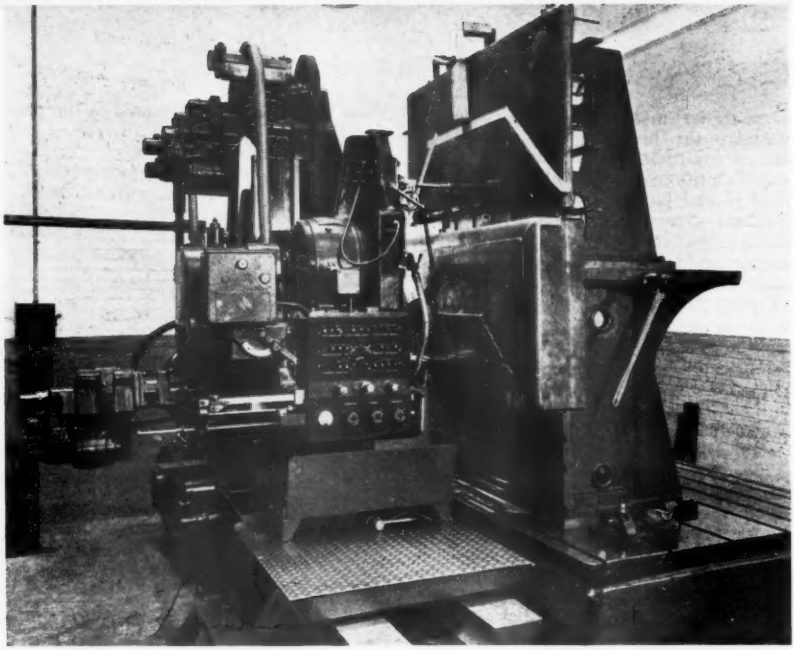


Figure 7

DUPLICATING WITH THE KELLER FROM GYPSUM CEMENT MODELS

	B-11 Hydrocal	A-11 Hydrocal	Pattern Shop Hydrocal
Normal consistency: parts water to 100 parts cement by weight to make a pourable slurry	48-50	40-42	50-54
Setting Time—Initial Gilmore (minutes) Final Gilmore	16-22 26-32	16-22 20-26	17-25 25-35
Setting Expansion (inches per inch)			
Maximum	0.0005	0.0005	0.002
Average	0.0004	0.0004	0.00125
Compressive strength (lb per sq inch)			
Minimum Wet	1750	2000	1500
Minimum Dry	3750	4500	3200
Surface Hardness (Monotron Test-Dry)	60	75	45
Suitability for template forming	GOOD	POOR	GOOD
Carving Characteristics	FAIR	POOR	GOOD

* Kg. load 0.01" penetration with 10mm diameter steel ball.

referred to, are shown in the accompanying table. A comparison of the properties of Pattern Shop Hydrocal and Hydrocal B-11 readily shows that the former should be used where carving and template forming are required, while the latter should be used where strength, template forming, and low setting expansion are essential.

Special Fixture Design Insures Accuracy In Sharpening Piloted Reamers

Except in the smaller sizes, the majority of hand reamers in use today are of the expansion (solid tooth) or of the adjustable (inserted tooth) type. There appears to be no standard method for sharpening expansion type hand reamers. The conventional method is to adjust such a reamer oversize a sufficient amount, grind it cylindrically to the exact size desired, and then back off the teeth so that sharp cutting edges are produced, the land being no more than a few thousandths of an inch wide. However, this method does not insure that the reamer teeth will be ground concentric with the front pilot surface, which guides the reamer in the hole. This consideration is important, especially in the case of hand reamers.

The Grinding Machine Division of Norton Company employs a method for sharpening their expansion hand reamers whereby this concentricity is assured. The procedure is to first adjust the expansion plug of the reamer so that the highest micrometer reading obtainable is from .002" to .004" over the nominal size. The amount of over size involved depends upon the size and condition of the reamer. The reamer, with the setting of the expansion plug undisturbed, is then placed between centers on a Norton Universal Tool and Cutter Grinder. The unique feature of this setup is the center which supports the expansion plug end. Being a floating type center, it permits centering the front pilot surface with an indicator. The reamer is now set up so that the teeth may be ground concentric with the pilot.

By means of a center gage the center of the wheel, the center of the reamer, and the tip of the tooth rest finger are all brought into the same plane. Provided a grinding wheel 4" in diameter is used, the wheelhead is raised so that the finger tip is set 1.2" below the center of the wheel and then this head is swiveled 9°. This will produce the

by C. T. Terpo

The Norton Company, Abrasive Division

Courtesy, "Grits and Grinds", The Norton Company

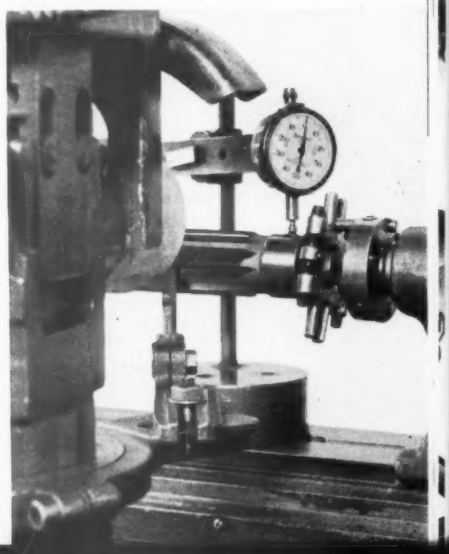


Figure 1. This floating type center insures that reamer teeth will be ground concentric with the pilot.

popular clearance of 5°. If a different clearance angle is desired the only adjustment required is to swivel the wheelhead to the new angular setting. The swivel table is tapped lightly so that the back of the reamer teeth will be ground from .00025″ to .0005″ undersize. This back taper, the amount of which depends upon the size of the reamer, helps to reduce any drag which might be produced in reaming.

The grinding is done with a flaring cup wheel, (4-3) x 1½ x 1¼″, 38A60-J5VBE *ALUNDUM* abrasive. Using both hand feed and hand traverse, approximately .001″ of stock per pass is ground from each tooth until nominal size is reached. A heavier feed is to be avoided as it is likely to cause burning and softening of the reamer teeth.

Since hand reamers are always ground with a taper or lead in order to allow them to enter holes freely and without chattering, the swivel table is readjusted to produce the desired lead. Each blade is then backed off so as to leave practically a sharp cutting edge. A few light strokes along the cutting edge with an India oilstone will remove any slight burrs produced in grinding. The width of land should be no more than a few thousandths of an inch wide. The amount of lead depends upon the amount of stock to be removed by reaming and is generally from $\frac{1}{16}$″ to $\frac{3}{8}$″ per foot and approximately ½″ in length for reamers up to 2″ in diameter and ¾″ in length for larger sizes.

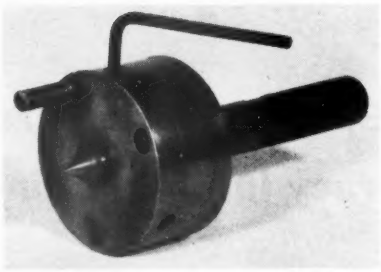


Figure 2. The adjustable, floating center as designed for sharpening expansion type hand reamers.

In addition to affording a means for grinding the reamer teeth concentric with the pilot, the above method has further advantage. By eliminating the cylindrical grinding operation, the amount of tooth stock ground per sharpening is reduced and since the maximum expansion for these reamers is relatively small, reamer life is increased.

Free Blueprint Inform-A-Gram Key No. 545.5-M. Readers wishing to make one of these center fixtures may obtain a detailed print and bill of materials upon request. Simply fill out one of our postage-free Inform-A-Gram cards, requesting Key No. 545.5-M

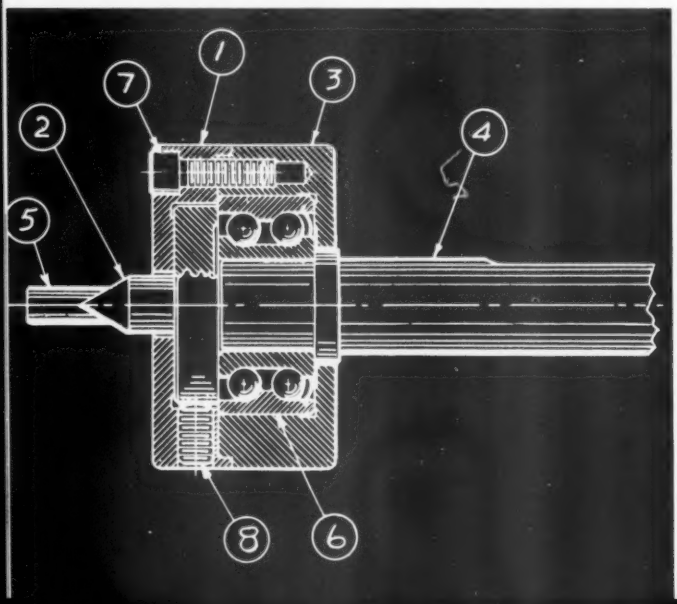


Figure 3. A blueprint with bill of materials may be had upon request.

Beryllium Alloys • Physical Properties and Production Applications

by N. W. Bass
Sales Manager, Brush Beryllium Co.
Cleveland, Ohio

The industry growing up around the metallic element, beryllium, will be as large as its ore supplies will support. This may be stated confidently because of the numerous valuable applications of beryllium developed over the last fifteen years, and which are far from being explored. This growth of application shows every indication of continuing.

Beryllium was discovered in 1798 in the emerald, a special form of the mineral beryl from which beryllium takes its name. The easily recognizable beryl (which contains about 12 percent beryllium oxide or 4 percent beryllium metal) has continued to be the commercial source upon which all manufacturers of beryllium rely. Although widely distributed, beryl is worked or procured in only a few places where labor is cheap enough to permit those hand operations by which beryl is presently mined and sorted. South America and India are the most favored spots with Australia now becoming important. Although steadily growing supplies of ore have always been more than sufficient to keep pace with applications in hand (over two years' supply is now in government stockpile), the industry cannot count on limitless amounts of raw material as in the case of aluminum and magnesium. Numerous other minerals of beryllium other than beryl exist but are not easily recognizable. The spectroscope and new chemical tests for use in the field are valuable tools now available for locating such difficultly recognizable ores and the outlook for the discovery of new sources is as good as for discovering new applications of finished beryllium products. Beryllium is estimated as lying between tin and arsenic in abundance in the earth's crust.

Beryllium products are still expensive, but much progress in price reduction has been made since 1930, when commercial activities succeeded the early research period from 1920 forward. The staff of the Brush Laboratories Company and the Brush Beryllium Company has been longer continuously concerned with beryllium in this country than has any other group. Relative to other materials, they expect beryllium products will continue their downward price trend.

Of the many chemical compounds of which the bivalent beryllium atom is capable, the sulphate, chloride, fluoride and oxide are the best known and simplest. Of these, the sulphate is the only stable soluble salt and forms the most convenient soluble base for use as a starting point in deriving other beryllium compounds. The anhydrous chloride and fluoride are both deliquescent and must be kept dry carefully to perform their service as prime sources for pure

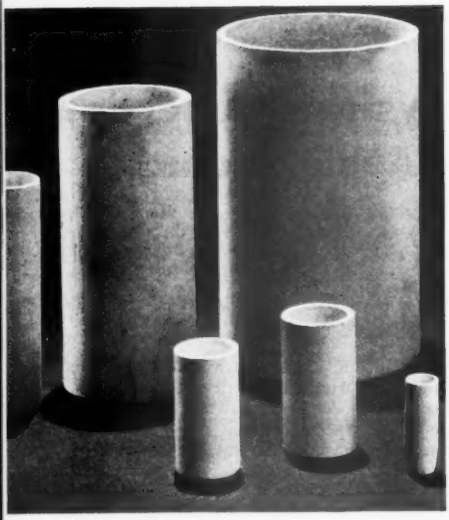


Fig. 1 — Beryllium oxide crucibles may be operated at 2000°C. This group ranges up to 12" in height.

beryllium metal, either by electrolysis or by reduction with magnesium, sodium, or calcium. Owing to its very great tendency to hydrolyse with evolution of hydrochloric acid gas, the chloride is more difficult to handle than the fluoride, which latter does not require more care than any good dehydrant. The chloride may be mixed and fused with ordinary salt to increase its stability in moist air. Beryllium compounds generally have a tendency to hydrolyse and thus tend with a few exceptions toward a basic condition and indefinite composition.

Beryllium oxide is insoluble and very stable. Its melting point is 2575° C which is 500° higher than that of aluminum oxide. Crucibles (Fig. 1) made from it may be operated in hydrogen or in a vacuum at about 2000° C and are noted for their resistance to thermal shock, high heat conductivity, and absence of contamination to the melt, which is especially important where very high purity metals are being melted. Such crucibles may be patched with beryllium oxide to give a long life and are the only solution for some high-temperature problems. Other refractory ware such as tubes, radio tube parts, etc., made of this material are especially interesting where high electrical resistance at elevated temperatures is required. Beryllium has this property to an outstanding degree and is a remarkable refractory.

Production of Beryllium Copper Master Alloy

The principal use for beryllium oxide is for the production of beryllium copper master alloy containing about 4 percent beryllium. This is accomplished by reduction of the oxide with carbon in an electric arc in the presence of divided copper, the beryllium metal so produced then alloying directly with the copper. Fig. 2 is a photograph of the arc furnace while making a pour. Its temperature is one of the highest used in nonferrous metallurgy. Beryllium copper provides the chief outlet for beryllium.

Another striking application of a beryllium chemical is in the new daylight or white fluorescent lights, where beryllium zinc silicate and magnesium tungstate constitute the two most important phosphors. Each is active over a range of about 2000 Angstrom units, with peaks respectively at about 6000 and 5000 Angstrom units. These new tubes are noted for their high efficiency and diffuse light.

Barium beryllonate is described in U. S. Patent No. 2,154,131, dated April 11, 1939, as a new "getter" for radio tubes. It has found some use for this purpose and is another example of the variety of uses found for beryllium chemicals.

Physical Properties

Beryllium metal itself is very nearly as light as magnesium, retains its polish as well or better than aluminum, and melts at 1280° C, a temperature higher than the melting point of copper, and almost as high as the melting point of nickel. Beryllium, therefore, is the only stable light metal with a high melting point. Unfortunately, its ductility is so low as to class it with the brittle metals, although recent work gives ground for hoping that enough ductility will be

present to permit its use in such applications as machine components. Beryllium also has a very high modulus of elasticity, namely about 40 million psi as compared with about 30 million psi for iron. Its low density and high modulus combine to produce a velocity of sound value of 41,300 feet per second, or about 2½ times as great as that for steel. This suggests acoustical applications. Its electrical conductivity is between 40 and 45 percent that of copper and it has very great penetrability by x-rays, being 17 times that of aluminum. This latter property, in combination with its high melting point, makes beryllium metal admirably suited for x-ray windows in x-ray tubes, as shown in Figure 3. Its use in these tubes has resulted in making possible the use of long wave x-rays of greater intensity for application to the light metals and also x-ray therapy. Beryllium metal may also be centrifugally and otherwise cast into simple geometric forms. These are of interest in nuclear research.

Although beryllium has applications in the aluminum and magnesium industry, it does not form an important bulk component of any of these alloys. On the other hand, when added in quantities of less than 1 percent to magnesium or aluminum, it modifies their behavior in a striking fashion. In the case of magnesium, the effect is really startling as only .005 percent of beryllium in magnesium will greatly reduce its inflammability and lessen its oxidation at the melting point. Despite a marked tendency toward coarse grains in cast magnesium alloys containing .005 percent beryllium, encouraging indications are obtained for controlling this grain size, and this use for beryllium will increase. Beryllium appears to alloy with magnesium only in small percentages. On the other hand, beryllium, when added to molten aluminum, may be dissolved in any amount, and alloys containing up to 40 percent of beryllium have interesting properties, especially for high temperature applications. These high beryllium alloys are limited by the difficulties of production and have been made only in the laboratory. Beryllium added to aluminum alloys in quantities from .1 percent to .5 percent contributes to the ease of casting and to thermal stability. It also refines the grain. Where perfection in an intricate casting is required, beryllium in amounts of .2 percent has been found to be very helpful in promoting fluidity. This alloy was used on a tonnage basis in Germany for making cylinder heads of air cooled engines [1].

For those interested in molds for plastics, the most important attribute of

Fig. 2—Pouring beryllium copper master alloy from the arc furnace. The temperature is one of the highest used in nonferrous metallurgy.

beryllium is as a very potent agent for producing precipitation hardening. This is used most commonly in copper but also applies to nickel and iron. There are, moreover, lesser known special precipitation hardening alloys such as ticonium for dental uses. The composition of this alloy is given as consisting in roughly equal amounts of nickel, cobalt, and chromium with also about 6 percent of molybdenum and 1-2 percent of beryllium. This low proportion of beryllium again illustrates its potency.

The maximum tensile strength is 110,000 psi with 0 percent elongation in 2 inches, which is up from 40,000 psi with 11 percent elongation when in the fully softened condition; corresponding hardnesses for the fully hardened and fully softened materials are 43 Rc and 18 Rc.

There are two corollaries to the use of

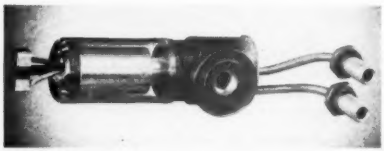


Fig. 3—Beryllium x-ray window in an oil immersed type diffraction tube.

beryllium as a precipitation hardening agent that are of importance in this type of alloy. The first is its very strong deoxidizing action when added to the metal. Although generally advantageous, an oxidized metal to which beryllium is added can waste a large amount of beryllium which will react with the oxides; this should be avoided. The second is the formation of a protective film of beryllium oxide over the surface of the melted or solid beryllium alloy. This film is tenacious and serves to keep the surface bright and shiny. This latter effect is notably absent in the 0.4 percent beryllium copper alloy hereafter described.

Precipitation hardening copper or nickel alloys relying on beryllium as the active agent are characterized by an ability to dissolve beryllium in solid solution over a range from 0.1 percent to 3.0 percent. More beryllium is dissolved at high temperatures, just short of the melting point, than at low temperatures. Consequently, when such an alloy is heated into the range of higher solubility for beryllium and quickly cooled from this temperature as by quenching in water, the beryllium is retained in a supersaturated solution and the alloy is soft and workable at room temperature. However, upon reheating to a relatively low temperature, generally less than red heat, the supersaturated solution rearranges itself atomically and perhaps crystallizes out submicroscopic particles of beryllium compounds which are densely scattered through the grains of the metal and operate to harden it greatly. This process of reheating to produce precipitation hardening may be exactly controlled so that a wide range of properties is obtained from the softest state with high ductility to the hardest state of minimum, perhaps zero, ductility.

In the case of beryllium copper, the best known alloys contain 2 percent of beryllium and from .35 percent to one percent of cobalt or nickel as a grain refiner and stabilizer. The solutionizing temperature is about 800° C and from this temperature the alloy is quenched in water to produce the material in its softest and most ductile condition. This condition is called the fully annealed condition and may show a tensile strength of 80,000 psi accompanied by an elongation of 35-50 percent in 2 inches. Upon reheating to about 300° C the tensile strength will rise to a minimum of 150,000 psi and the elongation in 2 inches will decrease to 5 percent. If the alloy is cold worked while in the annealed condition and then heat treated, its tensile strength will increase to a minimum of 180,000 psi and the elongation will decrease to 1 percent in 2 inches. Its electrical conductivity in the annealed condition is about 17 percent that of copper, but in the heat treated condition may range up to about 25 percent that of copper. Where strip, plate, wire or rod are concerned, the mills are accustomed to furnish these products in the fully annealed (or quenched) condition, or with various degrees of work hardening, to fit the specific application. Special techniques have grown up for handling the inevitable refinements and may be found described in the catalogues of the American Brass Co. and Riverside Metal Co. and in special articles. [2] & [3]

(1) *Sawyer, C. B. and Sloman, H. A. —"The Beryllium Industries of Germany and Italy (1939 to 1945)"*
(2) *Williams, H. G.—Iron Age, Dec. 6, 1945*
(3) *Martin, Wayne—Metals and Alloys, June, 1943*

The concluding section of this article will appear in the July issue.

TDJ SHOP DATA SHEET NO. 37

Rectangular Co-ordinate Dimensions vs Polar Co-ordinates

There are several methods used in dimensioning drawings for jig borer work, and the one employed usually depends on the type of table on which the work is to be done. Rectangular co-ordinates or "step" dimensions are used when a rectangular table is available, and polar co-ordinates are used for rotary table work.

However, to facilitate shop scheduling it is sometimes necessary to convert the type of dimensions from one to the other.

The following demonstrations are of the necessary steps in making such conversions. The drawings show the same layout of holes.

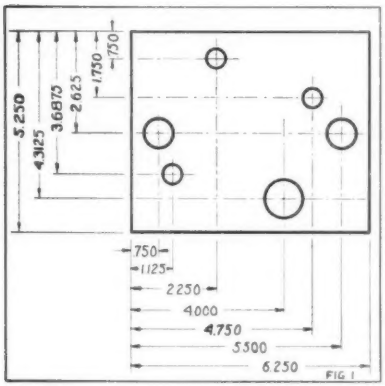


Figure 1, shows a layout with "step" dimensions. Figure 2 is the same as Figure 1, with the conversion to polar co-ordinate dimensions super-imposed, utilizing the center of one of the holes as the layout center.

The values were obtained by forming simple right triangles and computing for them by trigonometry.

Let line X-X pass through the center of H_0 and parallel to MN. Line X-X is then the base line and lines drawn from the center of H_0 to the centers of H_1, H_2, H_3, H_4, and H_5 form the radii to these holes, noted as R_1 to R_5 inclusive. The angles formed by X-X and R_1 to R_5 inclusive are to be determined, also the values of R_1 to R_8 inclusive.

For the purposes of clarity let VH_1 represent the vertical distance to the center of H_1 from X-X, and HH_1 the horizontal distance from H_0 along or parallel to X-X. These are the known values of the triangles formed by them and R_1.

Then $VH_1 = 4.3125 - 3.6875 = .6250$
$HH_1 = 4.000 - 1.125 = 2.875$
$VH_2 = 4.3125 - 2.625 = 1.6875$
$HH_2 = 4.000 - .750 = 3.250$
$VH_3 = 4.3125 - .750 = 3.5625$
$HH_3 = 4.000 - 2.250 = 1.750$
$VH_4 = 4.3125 - 1.750 = 2.5625$
$HH_4 = 4.750 - 4.000 = .750$
$VH_5 = 4.3125 - 2.625 = 1.6875$
$HH_5 = 5.500 - 4.000 = 1.500$

The values of the angles a and radii R are found in the following manner.

Angle a_1 is formed by R_1 and HH_1 with VH_1 completing a right triangle.

$$\text{Tan } a_1 = \frac{VH_1}{VH_2} = \frac{.625}{2.875} = .21739$$

Then $a_1 = 12° 15' 54''$ (See Table)

$$R_1 = \frac{VH_1}{\text{Sin } A_1} = \frac{.625}{\text{Sin } 12° 15' 54''} = \frac{.625}{.21243} = 2.94214$$

$$\text{Tan } a_2 = \frac{VH_2}{HH_2} = \frac{1.6875}{3.250} = .51923$$

Then $a_2 = 27° 26' 23''$ (See Table)

$$R_2 = \frac{VH_2}{\text{Sin } a_2} = \frac{1.6875}{\text{Sin } 27° 26' 23''} = \frac{1.6875}{.46081} = 3.662$$

$$\text{Tan } a_3 = \frac{VH_3}{HH_3} = \frac{3.5625}{1.750} = 2.03571$$

Then $a_3 = 63° 50' 20''$ (See Table)

$$R_3 = \frac{VH_3}{\text{Sin } a_3} = \frac{3.5625}{\text{Sin } 63° 50' 20''} = \frac{3.5625}{.89755} = 3.9691$$

$a_4 = 180° - S_4$, where S_4 = the angle formed by R_4 and HH_4.

$$\text{Tan } S_4 = \frac{VH_4}{HH_4} = \frac{2.5625}{.750} = 3.4166$$

$S_4 = 73° 41' 20''$ (See Table)

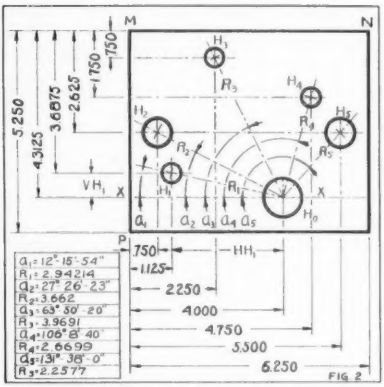


FIG. 2

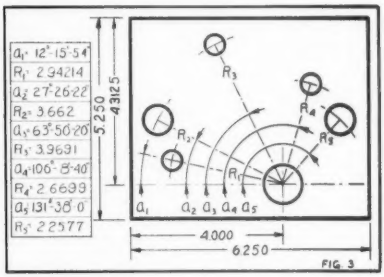


FIG. 3

Then $a_1 = 180° - 73° 41' 20" = 106° 8' 40"$

$$R_4 = \frac{VH_4}{\text{Sin } S_4} = \frac{2.5625}{\text{Sin } 73° 41' 20"} = \frac{2.5625}{.95975} = 2.6699$$

(See Table)

$a_5 = 180° - S_5$ where S_5 = the angle formed by R_5 and HH_5

$$\text{Tan } S_5 = \frac{VH_5}{HH_5} = \frac{1.6875}{1.5} = 1.125$$

$S_5 = 48° 22' 0"$ (See Table)

Then $a_5 = 180° - 48° 22' 0" = 131° 38' 0"$

$$R_5 = \frac{VH_5}{\text{Sin } S_5} = \frac{1.6875}{\text{Sin } 48° 38' 0"} = \frac{1.6875}{.74741} = 2.2577$$

(See Table)

Figure 3 represents the layout in Figure 1 converted to polar co-ordinates. With Figure 3 taken as the original, in order to convert it to "step" dimensions, the procedure would be as follows, working through Figure 2. Angles a_1 to a_5, and the values of R_1 to R_5 are known. The problem is to determine the distance of the center of each hole, vertically from the upper horizontal edge and horizontally from the left-hand edge.

The same symbols will be used as in the preceding example. VH and HH are found through the Sine and Cosine formulas with a and R the known values. Symbols MH will be used as the required vertical dimension and PH as the horizontal. In Figure 2, MX is the distance of the base line X-X from the top edge, therefore the vertical distance of the center of hole H_1 from the top edge is MX-VH_1, also XH_0 is the distance of the center of H_0 from the left-hand edge.

$$\text{Sin } a_1 = \frac{VH_1}{R_1}$$

$VH_1 = R_1 \text{ Sin } a_1 = 2.94214 \times \text{Sin } 12° 15' 54" = 2.94214 \times .21243 = .625$ (See Table)

$MH_1 = MX - VH_1 = 4.3125 - .625 = 3.6875$

$$\text{Cos } a_1 = \frac{HH_1}{R_1}$$

$HH_1 = R_1 \text{ Cos } a_1 = 2.94214 \times \text{Cos } 12° 15' 54" = 2.94214 \times .97718 = 2.875$ (See Table)

$PH_1 = XH_0 - HH_1 = 4.000 - 2.875 = 1.125$

$VH_2 = R_2 \text{ Sin } a_2 = 3.662 \times \text{Sin } 27° 26' 23" = 3.662 \times .46081 = 1.6875$ (See Table)

$MH_2 = MX - VH_2 = 4.3125 - 1.6875 = 2.625$

$HH_2 = R_2 \text{ Cos } a_2 = 3.662 \times \text{Cos } 27° 26' 23" = 3.662 \times .8875 = 3.250$ (See Table)

$PH_2 = XH_0 - HH_2 = 4.000 - 3.250 = .750$

$VH_3 = R_3 \text{ Sin } a_3 = 3.9691 \times \text{Sin } 63° 50' 20" = 3.9691 \times .89755 = 3.5625$ (See Table)

$MH_3 = MX - VH_3 = 4.3125 - .35625 = .750$

$HH_3 = R_3 \text{ Cos } a_3 = 3.9691 \times \text{Cos } 63° 50' 20" = 3.9691 \times .44090 = 1.750$ (See Table)

$PH_3 = XH_0 - HH_3 = 4.000 - 1.750 = 2.250$

$VH_4 = R_4 \text{ Sin } (180° - a_4)$
$= 2.6699 \times \text{Sin } (180° - 106° 8' 40")$
$= 2.6699 \times \text{Sin } 73° 41' 20"$
$= 2.6699 \times .95975 = 2.5625$ (See Table)

$MH_4 = MX - VH_4 = 4.3125 - 2.5625 = 1.750$

$HH_4 = R_4 \text{ Cos } a_4 = 2.6699 \times \text{Cos } (180° - 106° 8' 40")$
$= 2.6699 \times \text{Cos } 73° 41' 20"$
$= 2.6699 \times .28085 = .750$ (See Table)

$PH_4 = XH_0 + HH_4 = 4.000 + .750 = 4.750$

$VH_5 = R_5 \text{ Sin } (180° - a_5) =$
$2.2577 \times \text{Sin } (180° - 131° 38' 0")$
$= 2.2577 \times \text{Sin } 48° 22' 0"$
$= 2.2577 \times .74741 = 1.6875$ (See Table)

$MH_5 = MX - VH_5 = 4.3125 - 1.6875 = 2.625$

$HH_5 = R_5 \text{ Cos } (180° - \text{Cos } a_5)$
$= 2.2577 \times \text{Cos } (180° - 131° 38' 0")$
$= 2.2577 \times \text{Cos } 48° 22' 0"$
$= 2.2577 \times .66436 = 1.500$ (See Table)

$PH_5 = XH_0 + HH_5 = 4.000 + 1.500 = 5.500$

These rectangular dimensions correspond to those in Figure 1.

TRIGONOMETRIC VALUES

Angles	Sin	Cos	Tan
12° 15' 54"	.21243	.97718	.21739
27° 26' 23"	.46081	.88750	.51923
48° 22' 0"	.74741	.66436	1.125
63° 50' 20"	.89755	.44090	2.03571
73° 41' 20"	.95975	.28085	3.4166

TDJ SHOP DATA SHEET NO. 38

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	3.500	3.750	4.000	4.250	4.500	4.750
3.125	7.32	7.52	7.73	7.93	8.12	8.31
3.250	7.48	7.70	7.91	8.11	8.31	8.50
3.375	7.66	7.87	8.08	8.29	8.49	8.69
3.500	7.83	8.05	8.26	8.47	8.68	8.87
3.625	7.99	8.21	8.43	8.65	8.85	9.06
3.750	8.16	8.38	8.60	8.82	9.03	9.23
3.875	8.32	8.55	8.77	8.99	9.20	9.41
4.000	8.48	8.71	8.94	9.16	9.38	9.59
4.125	8.64	8.88	9.11	9.33	9.55	9.76
4.250	8.80	9.04	9.27	9.50	9.72	9.94
4.375	8.96	9.20	9.44	9.67	9.89	10.11
4.500	9.12	9.36	9.60	9.83	10.06	10.28
4.625	9.28	9.52	9.76	10.00	10.22	10.45
4.750	9.43	9.68	9.92	10.16	10.39	10.62
4.875	9.59	9.84	10.08	10.32	10.55	10.78
5.000	9.74	10.00	10.24	10.48	10.72	10.95
5.125	9.90	10.15	10.40	10.65	10.88	11.12
5.250	10.05	10.31	10.56	10.80	11.04	11.28
5.375	10.20	10.46	10.72	10.96	11.20	11.44
5.500	10.35	10.62	10.87	11.12	11.36	11.60
5.625	10.50	10.77	11.02	11.28	11.52	11.76
5.750	10.65	10.92	11.18	11.43	11.68	11.92
5.875	10.80	11.07	11.33	11.59	11.84	12.08
6.000	10.95	11.22	11.48	11.74	12.00	12.24

Special Tooling Set-Ups For Induction Brazing Of Carbide Tips

Adopting induction heating for the brazing of tungsten carbide tips to more than 200 types of cutting tools effected such savings that one tool manufacturer was able to amortize the cost of his two induction machines in three months' time.

Something of an innovation in the technique of brazing tips to cutting tools, this application of induction heating brought about greatly increased output with no increase in manpower. One of the factors bearing on the enlarged production is a rotary fixture which enables one operator to do in an hour what formerly was achieved in approximately eight.

Constantly furthering new tool brazing applications by induction heating, F. H. Willey, president of The Willey's Carbide Tool Company, Detroit, advised that "shipments went up 20 percent in one month with no increase in manpower, and where certain jobs had costs as high as $4.00 per hour, the use of induction brazing had reduced these same costs to as low as 30 cents an hour."

In foreground, girl operator is brazing a ¾" tool held in a screw clamp fixture. In rear, operator (twin sister) is wiping tip into place on a big 1¼" x 1½" straight shank shell turning tool. The induction machine is a 15 kw unit.

These operations are being performed on two 15 kw, two-station, 9600 cycle TOCCO (The Ohio Crankshaft Company) units equipped with water-cooled inductor coils which can be easily changed to accommodate different tools. With two stations each, these compact, self-contained units of 48" x 32" base dimensions, are located in the production area of the shop, where they provide full capacity operations.

Compared to other methods used to braze tips, the following cost-cutting advantages of induction treatment were cited: (1) Induction heating eliminates excess braze metal from the shank of the tool; (2) It does away with wiring tip to shank; (3) It reduces wear on the finish grinding wheels by elimination of the wiring on tip; (4) It is cooler and cleaner; (5) It is a more positive, uniform type of braze; and (6) It holds rejects to a fraction of a percent.

The inherent characteristics of high frequency currents to concentrate on a selected area make induction heating an ideal medium for tool brazing. The heat can be restricted to the tip end which leaves the remainder of the shank cool enough so that in most cases an operator can handle the finished piece with a gloved hand. Tongs are needed only on the smaller tools.

High frequency currents, when carried through an inductor, will create a magnetic field within the space it en-

circles and will induce a flow of current in any material capable of serving as a conductor. Not only does this material act as a conductor of the induced current, but it also has a resistance to this flow of energy so that it is possible to compare induction heating to straight resistance heating.

No complicated technique is required to braze properly a tip of any of the many styles of tools produced in the Willey's plant. The operator, with the tip and brazing material positioned in the fixture recess, places the tool beneath the inductor. The heating cycle may run from three seconds upwards to a minute, depending upon the type of tool being brazed. As the heating progresses, the operator, by use of a small rod, "wipes" the tip into place as the material softens. Cycles can be controlled automatically or manually.

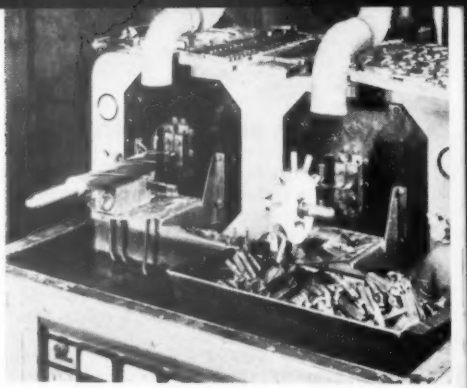
Tools are held beneath the inductor by one of three methods, of which the rotary chuck, already mentioned, is one. The other two are either by a screw-clamp fixture or by a magnetic chuck block, of which two sizes are used, 3" x 6" and 4" x 6". With the magnetic block, big tools can be easily positioned beneath the inductor in rapid fashion, where they are held firmly during the brazing cycle.

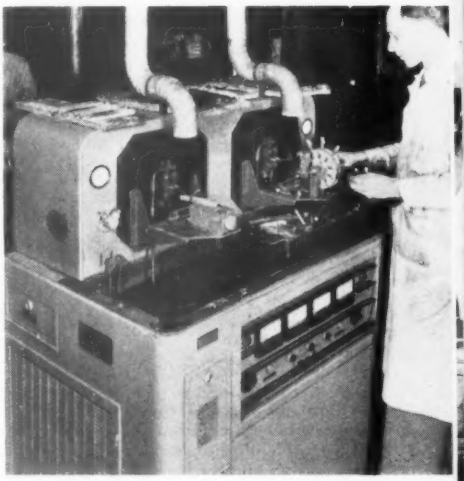
Rotary Chuck

The rotary fixture designed in the shops of the Willey's Company is a transite block 6 inches in diameter with a 1½ inch face mounted on a revolving spindle attached to an upright support. The block has a capacity upwards of 20 tools ranging in size from ¼" to ¾" square and of moderate length.

Only three bolts are needed to hold the rotary block which can be easily removed to allow for a change in size of shank. Because the mechanism of the fixture is attached to a stationary bracket, an adaptor plate is used when changing to another size. The tools are held in the fixture by spring tension and, as the operator rotates the block (he does so manually), the tool enters the field of the inductor coil where it becomes heated. The tip is "wiped" in place by the operator during the heating, after which the tool passes down and out of the inductor as the very short cycle concludes. Held by mechani-

(CONTINUED ON PAGE 114)





Top—Front view of the rotary fixture with tools in place ready for brazing on the TOCCO unit. Three bolts are all that need be removed to allow for changing tool fixture. Tools drop into pan below following brazing. At left is a magnetic chuck block holding a big drill. The tips on the small tools are held in place by the adhesive quality of the brazing material.

Bottom—View of rotary fixture showing rear support and operator about to insert tool preparatory to brazing. The tools turn in towards the machine as the operator revolves the fixture by hand.

Rigidity and Gripping Power Designed Into Tool Holder

The exclusive design features of the Cooper-Bessemer tool holders offer many advantages to the user. This new line of lathe turning and cut-off holders is drop-forged from a special analysis steel selected for its toughness, strength and maximum resistance to wear. They are heat treated and hardened to retain their sturdy characteristics.

The blade side of a completely assembled type "TLC" turret lathe cut-off tool holder is shown in Figure 1. The straight model turning tool holder is pictured in Figure 2. This model is also available in right- and left-hand types. The patented feature is a clamping pin which holds the cutting bit rigidly in place as illustrated in Figure 3.

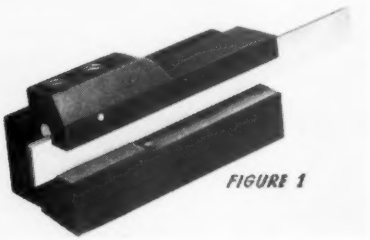


FIGURE 1

A light pressure of the two flush-type set screws on the clamping pin locks the tool bit or blade in position with a vise-like grip, absolutely preventing slipping. A dowel holds the clamping pin in position for inserting the cutting tool and prevents the pin from falling out when the bit is removed. The dowel is easily taken out to permit removal of the clamping pin when necessary.

In turning operations, the bit is gripped for nearly its entire length and creates virtually a solid mass of bit and holder, thus providing better heat dissipation. There are no mutilated or broken bits from set screw pressure. Bits as short as they can be ground may be used. They are held firmly in place and supported to the very nose of the holder. Oversize and undersize bits are held equally rigid. Tool bits cannot chatter and will take heavier cuts with higher speed and feed. The holder channel under the bits cannot wear concave. The

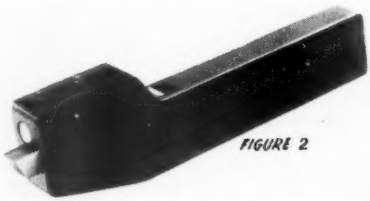


FIGURE 2

tool bit may be removed for grinding or renewal and replaced in the holder at any desired position without disturbing the adjustment of the holder in the tool post.

The cutoff blade is held securely vertical by a clamping pin at the top of which is accurately machined to a V-groove at the bottom. The blade is positioned horizontally and parallel to the base of the holder.

The clamping pin in the cut-off holder engages a considerable portion of the blade, holding it to a true cutting position regardless of the side pressure imposed on the blade. Pressure is evenly distributed on the blade without excessive strain at any point. This new method of holding permits the use of a shorter blade so that a greater portion of the original blade lengths may be used. Chatter and any undesirable movement of the blade is prevented, making the holder especially ideal for precision work. They are being produced in models for both engine and turret lathes. These new tool holders augment the company's production of standard carbidetipped tools.

The manufacturers have had the distinct advantage of being able to test these holders in their own plant and will furnish additional specifications upon request. Write The Cooper-Bessemer Corporation, Industrial Tool Div., Dept. DJ, Mount Vernon, Ohio.

INFORM-A-GRAM KEY No. 85-M

FIGURE 3

Resistance Welding: A Tool For High Production

by K. R. Van Tassel
Manager, Industrial Control Division
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Schenectady, N. Y.

During the war, many new users found that resistance welding proved to be an ideal fabricating tool, with the result that the use of this method increased approximately three-fold. It was the common experience that resistance welding had the advantage of low cost, high employee productivity, better appearance, minimum distortion, and required neither added material nor, in the case of automatic machines, special skill on the part of the operator.

Just one illustration: A simple stud weld used in the manufacture of transformer tanks, ironer shoes, and similar containers, requires only a single operation when the stud is projection-welded to the part being fabricated. The process previously used for this purpose required a total of seven operations. In the average spot-welding operation, the gun or the press-type welder generally operates from 60 to 80 times per minute, although there are in operation a large number of these particular welders which operate at much higher speeds. In fact, in one application involving a weld on a container of light metal, spot welds are made at the rate of approximately 400 per minute, or over half a million per day.

Freedom from distortion, of course, is an important factor when considering all-over costs. With resistance welding, the time of current flow is generally very short, usually less than one second, which means that most of the energy and resulting heat is at the weld zone. With other forms of welding, the heat application is much longer. Consequently, an appreciable amount of the heat is dissipated into the surrounding material, which often leads to undesirable distortion. In the manufacture of switchgear framework, for example, the actual cost of spot welding compared with other forms of welding is approximately the same. There is, however, an over-all saving since the straightening operation is not required. So, then, freedom from distortion is an important consideration, not only in the case of large structures but even with very small

Fig. 1. An indication of the variety of products and components that can be fabricated by resistance welding.

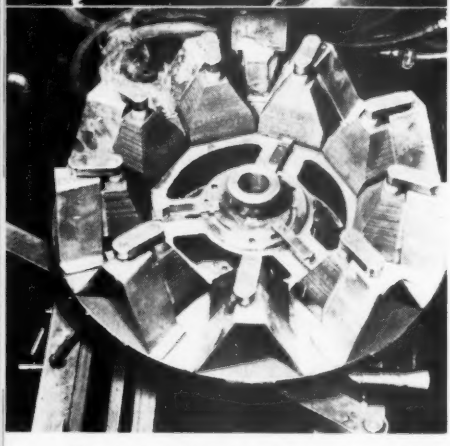


Fig. 2. High production seam welding being employed in the manufacture of refrigerator evaporators.

Fig. 3. An indexing fixture for the projection welding of fans for large motors. This is done at the rate of 25 units per hour.

parts, such as those used in the manufacture of electronic tubes.

Since the resistance welding process does not require the addition of material, this results frequently in a reduction in weight as well as a decided saving in material. Resistance welding is extensively used in the aircraft industry, where strength and light weight are of great importance. The modern aircraft is a structure with a very high degree of stress. Obviously, this means that the strength of each weld must be as close as possible to the design value. In addition, it is desirable that the sections should not be reduced, as required by riveting, so that increased strength for the same weight of material is achieved. Resistence welding has proven itself ideal for this type of fabrication.

The virtue of resistance welding is that when combined with a welder equipped with suitable fixtures, the entire fabricating process can be made highly automatic. This not only reduces manufacturing costs but provides the individual employee with an effective means for increasing his productivity, since the welder requires little attention, and for that matter, often the employee can easily tend several machines. He needn't be highly skilled to do this, either.

For this reason alone, it is my feeling that a large percentage of the resistance welding machines of the future will be specially designed for given fabricating jobs. Naturally this implies that many present-day machines are either rather obsolete or will have to be equipped with special jigs and fixtures for automatic operation. For example, prior to the war, refrigerator liners were manufactured at the rate of 35 per hour. Today, newly designed welders produce these liners at the rate of 100 per hour. Obviously, with our entire industrial system daily being more highly mechanized, the use of such machines will become increasingly imperative.

The use of both aluminum and air-hardenable steels, which require special electronic control equipment for fabrication purposes, will substantially increase, so that the benefits from the use of these materials—reduced weight and increased strength—may be obtained. Casting into the future, the welding of scaly materials for structural purposes, which now is carefully avoided, may be successfully accomplished. These are two instances where without electronic control equipment the welding of these materials would be impossible.

It is a fact that we are still far from realizing the fullest possibilities of resistance welding generally.

INDUSTRIAL DIGEST

Science • Research • Methods • Tooling • Production • Trade News and Reports

The American Society of Body Engineers

Announcement has been made of the formation of a new engineering society called "The American Society of Body Engineers, Incorporated" by its president, Mr. I. Louis Carron, body engineer of the Detroit Harvester Company. The society has been organized as a non-profit corporation with national headquarters in the Rackham Memorial Building in Detroit, Michigan. This is an aggressive organization composed entirely of leading body engineers from practically all the companies in the automotive industry.

Mr. Carron states that the forerunner of the present day body engineer was a carriage maker, an artisan, who at the turn of the century, was capable of designing and building his own carriages. He had to be an artist as well as a first class wood worker and upholsterer. It was natural for men of these talents to turn to the building of bodies for the new contraptions then called "horseless carriages". Very few of these men were college trained engineers, and any knowledge of engineering was acquired through practical experience. Today, a successful body engineer must be well versed in the fundamentals of engineering and in addition, must be a good artist. There is no part of an automotive vehicle as important as its body with its flowing lines and pleasing contours which needs the touch of the artist in its design, as well as the use of the fundamentals in engineering for the proper selection of materials for its construction.

Recognition of the fact that Body Engineering has reached the status of a profession is seen in the recent announcement of the University of Michigan that this fall it will start a course in Body Engineering which will lead to the granting of a degree in Engineering.

A Technical Convention will be held in October by this society, The American Society of Body Engineers, Incorporated, in the Rackham Memorial Building with Mr. Carl W. Cenzer as General Chairman. Elaborate plans are already well underway. Committees are being formed and are to be headed by capable and experienced men who have devoted many years toward the progress of body design and engineering.

First Postwar Machine Tool Forum

Attendance to the tenth annual Machine Tool Electrification Forum held in Pittsburgh, Pennsylvania, under the sponsorship of Westinghouse, reached prewar levels with 232 delegates registered. Represented were 113 companies that produce machine tools, 19 editors of technical magazines, 4 engineering associations and 3 government purchasing commissions.

The theme of the Forum was—higher quality products in volume and at prices everyone can afford. Papers presented dealt with domestic and foreign markets, the case of standardization, electrical equipment for automatic tools and trends in machine tool wiring methods.

The two-day session was opened by D. W. McGill, Manager of the Westinghouse Machinery Electrification Section, who also acted as chairman.

Illustrated talks were presented by: W. B. Wigton, Cincinnati Planer Company; B. T. Anderson, Sundstrand Machine Tool Company; R. H. Clark, Warner & Swasey; A. L. Krause, Brown & Sharpe; E. E. Opel, National Automatic Tool Company; R. Griffith, Heald Machine Company; R. W. Moore, L. W.

Herchenroeder, H. D. Dorfman, and C. E. Herr, Westinghouse.

R. M. Gaylord, President, Ingersoll Milling Machine Company, spoke at the annual banquet which concluded the Forum.

SAE meetings and publications are making comprehensive reports on German automotive engineering progress.

Convert German Automotive Progress To American Use

Summaries of 61 technical reports prepared by automotive subcommittees of Technical Industrial Intelligence Committee, as well as engineering symposium and exhibit of German Equipment, are program features of the SAE's Summer Meeting June 2 to 7, at French Lick, Ind.

Technical studies of German air, land, and amphibious vehicles already presented at SAE meetings characterize Nazi engineering as governed largely by expediency, handicapped by military rigidity and industrial monopolies. Reports suggest Nazis quickly copied captured equipment, ascribe defeat in part to Hitler's failure to coordinate design and production with rapidly changing strategic needs.

Harvey B. Wallace, president of Wheel Trueing Tool Company, Detroit, and president of Adamant Tool Company of Bloomfield, New Jersey, has been elected president of the newly formed Industrial Diamond Association of America. Charter membership in the Association is composed of manufacturers of diamond tools and processors, importers and distributors of diamonds for industrial purposes.

Industrial Diamond Association of America

Wallace states that many important and even revolutionary advances were made by the diamond tool industry during the war in the development of diamond tools and in their application to important and critical war production jobs. In many instances the saving in time and the reduction of rejects through the use of special diamond tools reached almost unbelievable proportions. However, many noteworthy achievements of the war production period are not generally known to users and potential users of diamond tools, and one of the purposes of the Association will be to disseminate such information so that through wider use the newest and best techniques in the use of diamonds and diamond tools can be translated into consumer benefits. The Association will also foster organized programs of research aimed at the same ultimate objective.

The April 1946 election of seven smaller manufacturers to serve as Governors of National Patent Council and to lead a nationwide educational program in defense of the patent system has been announced by John W. Anderson, Gary, Ind., manufacturer of automotive equipment and president of the Council. Elected were: Henry K. Norton, treasurer, Walter Kidde & Company, New York, N. Y.; Melvin M. Johnson, Jr., president, Johnson Automatics, Inc., Boston, Mass.; E. A. Terrell, president, Terrell Machine Company, Charlotte, N. C.; Phil T. Sprague, president, The Hays Corporation, Michigan City, Ind.; W. L. McKnight, president, Minnesota Mining and Manufacturing Company, St. Paul, Minn.; C. B. Hasford, president, L.P.G. Equipment Corporation, Dallas, Texas; and Jay C. Perrin, president, Towlsaver, Inc., Los Angeles, Calif.

National Patent Council Elections

"Each of these seven outstanding men represents a geographical division of National Patent Council and will be a militant leader for many hundreds of smaller manufacturers who have joined together to combat the insidious propaganda of Washington agencies now openly seeking to disable the patent system", Mr. Anderson said.

The new Governors will meet soon at the Council's Gary headquarters to intensify for the ensuing year a "program of educational activities that will carry to the grassroots of America a renewed

SUGGESTION BOX
HERE'S ANOTHER SOUND SUGGESTION!
SUGGESTION CARD
WE CAN SAVE HOURS OF TOOLING-UP TIME BY USING MASONITE DIE STOCK!
NAME Bill Reed

When you use Masonite* Die Stock, you'll find more dies and jigs being turned out in less time and at a lower cost!

This is particularly true when tooling up for the fabrication of sheet metals—especially copper, brass, steel and aluminum. The aircraft industry found Die Stock a tremendous boon during its gigantic production program and is today using more of this unique semi-plastic per plane than ever before.

Die Stock is easily processed by high-speed equipment in wood or metal shop . . . saves precious tooling-up time, slashes costs. Dense, super-smooth and grainless, it won't check, twist, shrink or split. Workers can handle Masonite Die Stock with ease, for it has but one-sixth the weight of commonly-used metals. Available in thicknesses of ¼ to 2 inches, it is easily laminated to greater thicknesses. It comes in panels 48 x 72 and 48 x 144 inches.

It will pay *you* to learn more about Masonite Die Stock! Besides using it for dies, jigs, assemblies and fixtures, many firms have found it practical for experimental tooling, for mock-ups and experimental models. Send the coupon for complete information.

*"Masonite" is a trade-mark registered in the U.S. Pat. Off., and signifies that Masonite Corporation is the source of the product.

MASONITE CORPORATION · 111 W. WASHINGTON ST., CHICAGO 2, ILL. · Masonite BRAND DIE STOCK FOR TOOLING

Product of the State of Mississippi

MASONITE CORPORATION, Dept. TD-6, 111 W. Washington St., Chicago 2, Illinois

Please send me illustrative literature and complete information about Masonite Die Stock.

Name .....

Firm and Title .....

Address .....

City ..... *Zone* ..... *State* .....

appreciation and understanding of the indispensable part which the patent system has filled in building America."

Dr. Todos M. Odarenko, technical assistant to the president of the International Telephone and Telegraph Company, New York City, has been assigned to direct an investigation of special developments in the German communications industry of interest to American manufacturers.

German Communications Industry Investigations

Dr. Odarenko is on leave of absence from his company. Although the company will bear the expenses of his trip, he will travel as a Government official. His report on the investigation will be made available to the public through the Office of the Publication Board, U. S. Department of Commerce.

The present mission was initiated by the Communications Unit of the Technical Industrial Intelligence Branch, Department of Commerce, and it follows up a more general survey of the German communications industry, made last year.

Before leaving, Dr. Odarenko consulted with representatives of 75 American communications firms to determine what special types of information on German developments would be most useful in solving the problems of the American industry.

Guided by this consultation, Dr. Odarenko plans to initiate investigation of the following German developments: local and long distance communication systems; teletypewriter, television, and facsimile systems; radio and radar devices and navigation systems for aircraft; ceramic and plastic devices; and component parts of communication equipment such as resistors, condensers, coils, vacuum tubes, and antennas.

German developments of particular interest to American manufacturers, according to Dr. Odarenko, include the following:

Condensers which are not only smaller than American condensers, but are practically indestructible, since they heal themselves when a breakdown is caused by overloading.

A die casting of magnesium, suitable for use as a radio chassis and in other electronic equipment. It can be mass-produced and does not require any finishing after casting.

The use of plastic and synthetic dielectric materials for antennas, radio parts, transmission lines, and insulation.

Devices using tape for recording sound.

Asked whether German technicians were generally superior to American technicians in the communications field, Dr. Odarenko explained that it was not a question of superiority, but rather a difference in research emphasis.

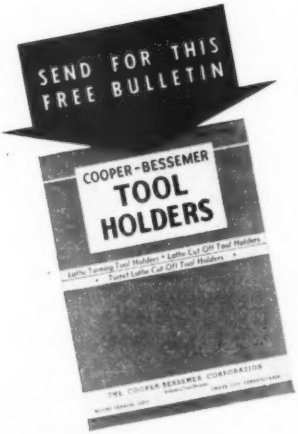
A complete working manual on the Technique of Job Analysis and Evaluation in the clerical, technical and administrative fields has been issued by The Weatherhead Company. The manual is standard 8½" x 11" size and consists of 135 pages of text. It is a complete, practical working manual of salary job evaluation. The manual explains in detail the procedures used and is designed to enable interested companies to install the program with their own people without aid of outside assistance. It takes the mystery out of job evaluation and permits anyone, with a good company background and knowledge of the jobs within an organization, to analyze and evaluate the jobs of his company and arrive at a schedule of proper and equitable salaries.

Job Analysis and Evaluation

The textbook has been written by Charles S. Mattoon, Director of Industrial Relations of the Weatherhead Company, nationally recognized expert on the subject.

"It is being made available to management officials on a national scale by the Weatherhead Company," says Mattoon, "in the interests of better management."

Copies can be secured without cost by management executives requesting it on company stationery by addressing The Weatherhead Company, 300 East 131st St., Cleveland 8, Ohio.



Secret behind the amazing success of the new Cooper-Bessemer Tool Holders is the patented holding device shown in the phantom view above. It combines so *many* distinct advantages, we suggest you ask for Bulletin No. 102-TH and get the complete story. Then judge for yourself whether you ought to give one or more of these unique holders a try. There are standard size turning holders and cut-off holders for both engine and turret lathes. Complete dimensions, specifications, operating characteristics and prices are given in the bulletin . . . yours for the asking.

THE Cooper-Bessemer CORPORATION

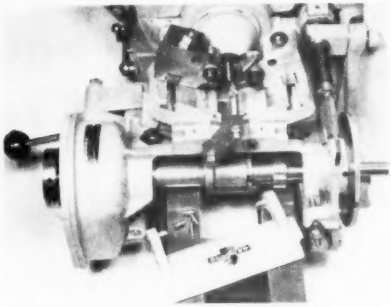
Industrial Tool Division
Dept. J, Mount Vernon, Ohio

COOPER-BESSEMERS CUT THE COST OF CUTTING

Lathe Tooling Speeds Forming and Cut-Off

The development of the "Dunamatic" lathe attachment is one more story to add to the already long list of cases demonstrating American ingenuity. Pressure of wartime needs to produce more parts in less time brought out latent skills when priorities and delivery dates were almost unsurmountable.

During the war the Dunn Engineering



Co. was manufacturing exclusively small, stainless steel, precision parts for gyroscope and precision instrument assemblies. Large numbers of these were a forming and/or cutoff operation. To speed up their production on these parts, they developed the "Dunamatic" to be used on either the Atlas or Logan lathe for automatic operation.

The attachment employs the use of face cams to control the operation of rocker arms which, in turn, control the operation of form and/or cutoff tools attached to them. Either circular or flat form tools or a combination of both may be used, the selection of type depending upon size of the production run. The rocker arms operate on pivots instead of slides, thus eliminating the necessity for constant adjustment. A means of adjustment is provided, however, when long usage might make simple adjustments necessary. Since all pivot parts are precision ground and properly hardened, adjustment is seldom necessary.

The stock is cam fed through a tube by feed fingers, into a collet, automatically, and a moving stock stop determines the length of the part to be formed and/or cut off. The collet closes automatically and is timed to coincide with the start of operation of the work tools.

The attachment is complete and can be affixed to the lathe without it being necessary to drill holes or in any way harm or deface it. Installation time is from one to two hours time. It can be removed at will and the lathe restored to normal service.

Power for the operation of the "Dunamatic" is taken from the standard lathe lead screw and transmitted, by means of a roller chain and steel sprockets, through a steel worm and bronze worm gear, providing efficient and quiet operation.

For full information relating to the "Dunamatic", address Dunn Engineering Co., Dept. TD, 6341-A Lydon Ave., Detroit 21, Mich.

INFORM-A-GRAM KEY No. H40-M

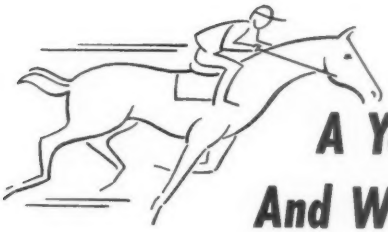
How To Locate Surplus Machine Tools

A bulletin has been issued by Pratt & Whitney, the purpose of which is to assist those interested in purchasing P&W machines, now held in U. S. Government surplus stocks, to locate them. The point is made that there are some real bargains if they can be found.

Through facilities set up at Pratt & Whitney Branch Offices, assistance will be given in locating the machine required. When a machine is located, a P&W man will inspect it, advise upon its condition, and what is necessary to put it in first class condition. If no standard model is found, but a special purpose machine is located, he will show whether it can be converted to a standard model and recommend the necessary alterations or equipment to bring it in line with the required specifications.

For copies of the bulletin "How to Locate The Pratt & Whitney Machines You Need" write Pratt & Whitney, Div. Niles-Bement-Pond Co., Dept. TJ, Charter Oak Blvd., West Hartford 1, Conn.

INFORM-A-GRAM KEY No. 430-M



A Yearling This June And Well In The Race

YOU CAN BET

on *Industrial Plastics*' pulling power. In less than one year of publication, we received more than 12,500 inquiries from our readers for further information about materials, processing equipment, tooling, supplies, plastics parts and components—inquiries in excess of 11% per month of our total circulation. Many additional inquiries from the same source went direct to the manufacturers concerned. Proof, we believe, of *Industrial Plastics*' effectiveness as a sales making advertising medium.

HERE'S A TIP

Effective July 1, 1946, advertising rates in *Industrial Plastics* will be increased approximately 20%. Contracts received prior to July 1 will earn present rates for the balance of 1946 and the first six months of 1947.

You gain in *Industrial Plastics* more circulation to the plants who mold, extrude, laminate and fabricate, than any other plastics publication. You cover, as well, the vigorous "industrial use of plastics" market—the mass production industries who in addition to processing plastics for use in their products are volume purchasers of custom made plastics parts and components.

LOOK AT THE RECORD

(June 1945 to May 1946)

43 articles on the use of plastics processing machines and equipment

22 articles on plastics extruding and preforming presses

42 articles describing properties and applications of plastics material

14 articles on mold design

5 articles on plant layout and plastics tooling

12 articles on preheating, drying and baking equipment

19 articles on processing of plastics

4 articles on plastics product design

15 articles on plastics testing, inspection and control equipment

17 articles on tools for plastics

29 articles reprinted from first 12 issues of *Industrial Plastics.*

CHECK THIS FORM

Available to you is a complete editorial index of the first 12 issues of *Industrial Plastics.* Write us today for your copy.

A HUEBNER PUBLICATION

INDUSTRIAL PLASTICS

2464 FAIRMOUNT BOULEVARD • CLEVELAND 6, OHIO

(CONTINUED FROM PAGE 103)

cal tension until it arrives at the vertical, the tool is released automatically from the fixture and drops into a tote box or onto a conveyor below.

Because the flux is sufficiently adhesive, it is not necessary to hold the tip in position by any other means as the tools pass into and out of the inductor.

Following are production figures for one Willey's operator using a 15 kw TOCCO machine:

¼"	sq.	Tool	Bits,	400	per	hour
5/16"	"	"	"	350	"	"
⅜"	"	"	"	350	"	"
½"	"	"	"	325	"	"
⅝"	"	"	"	275	"	"
¾"	"	"	"	250	"	"

Further advantages of the induction method are reported to be the opportunity to silver solder high speed steel tips without drawing the hardness of the tip. Also, induction heat simplifies the removal of a brazed tip from a shank by quickly remelting the brazing material.

Larger tools, 1¼" x 1½" for example, are now being treated in greatly increased quantities. Two girl operators turn out 85 of these an hour on a two-station unit in contrast to the 80 tools per 8-hour day by older methods. It is with these larger tools wherein induction's economies are seen to best advantage and the method of operation is the utmost in simplicity. Here Willey's has used a single magnetic chuck block 6 inches long for holding the big shanks.

Uniquely achieved by the induction process is the brazing of a two-tipped tool without the wiring required to secure the tips for treatment by other methods. The tips are held in place during the heating without extra support. The same is experienced in the treating of drills, reamers and counterbores, among others.

Brazing of diamond dressing tools, for straight or radius dressing, having but a single diamond, was always difficult to handle and slow to braze. Now, after the stone is positioned and the matrix base is pressed into the tool cavity around the diamond, one girl can braze 150 to 200 half-inch tools an hour. The cycle is three seconds heating per dresser.

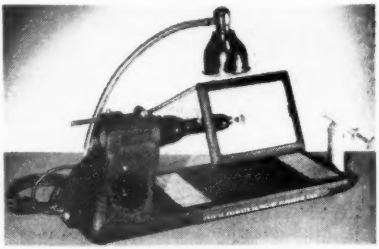
Two interesting and formerly difficult brazing jobs are the brazing of tips to line reamers having a 20° spiral with inserts running the complete length of the 5" cutting edge, and the brazing of broach buttons ¼" to 1" in diameter. Each is now quickly and uniformly accomplished by induction heating.

Detailed specifications of induction heating equipment may be obtained from The Ohio Crankshaft Company, Dept. DJ, 3806 Harvard Avenue, Cleveland, Ohio, or use our

INFORM-A-GRAM KEY No. 415-M

Increasing Speed and Accuracy

Increased accuracy and speed in grinding, finishing and polishing of small products and parts made of steel, nonferrous metals, plastics, glass, wood, etc., is assured when done on a Precise Vari-Speed Lathe. By incorporating a Precise-35 Electric Grinder and Handtool into a lathe unit with a built-in speed control, the Precise Products Company have developed this small high-speed lathe for use on a bench or table.



The power unit can be detached and used separately as a handtool for grinding, milling, deburring, finishing and polishing. The case of the handtool is made of a practically unbreakable light plastic. The entire tool is guaranteed shockproof without a ground wire. An 8-point grip collet firmly holds over one inch of the tool shank.

Complete specifications on this remarkable handy tool may be obtained from the Precise Products Company, Dept. DJ, 1328-30 Clark St., Racine 3, Wis.

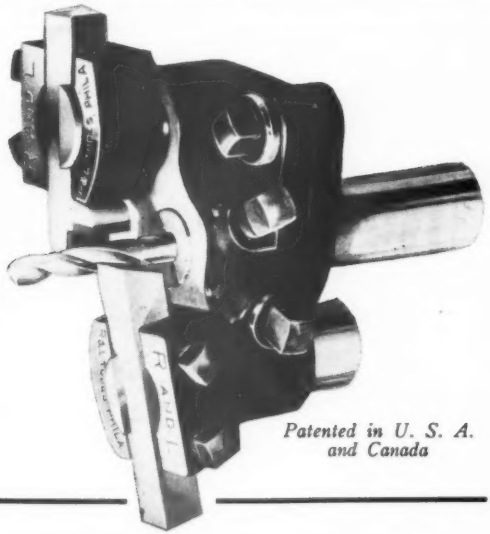
INFORM-A-GRAM KEY No. B21M

14

Tools In One

R and L COMBINATION TURNING TOOL

At ¼ The Cost



Patented in U. S. A. and Canada

One R and L (right and left) Combination Turning Tool actually does the work of all these for either right-hand or left-hand operations: *Roller Box Tool; Centering and Facing Tool; Knee Tool; Pointing Tool; Back Rest; Floating Drill Holder; Balanced Turning Tool.*

The R and L is the only combination right-hand and left-hand tool on the market; change from right to left or vice versa takes only ten seconds.

R and L TOOLS

1825 Bristol St.

Philadelphia 40, Pa.

SOME OTHER NOTABLE FEATURES

- Made of extra tough, heat treated alloy steel; unconditionally guaranteed not to bend or give way
- Essential parts ground to extreme accuracy affording perfect alignment at any point of adjustment
- Back Rests, or burnishers, have almost diamond hard surfaces eliminating metal pick-up and marring of work surface
- Interchangeable Roller Back Rests furnished if desired
- Precise adjustment on both cutting tool and pressure of burnishers
- Tool bits wear longer because they are ground only on top side, or end
- Less cross-slide clearance required; saves time and often permits working with cross-slide tools while turning or drilling
- On turnings, the R and L Combination Tool produces highly polished surfaces, true to size, and straight
- Longitudinal adjustment permits turning of two diameters to any length within tool capacity

All these and many other features are shown by photographs and drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.

No Leaks
No Levers
No Packing

Air-O-cheks have the ball and socket joining the enclosed lever to the valve.

Note double grip afforded by long, extra heavy ferrules machine-formed over special shoulder on shank.

Made of Bar Brass and Stainless Steel

Comparison quickly demonstrates such Air-O-chek advantages as leak-proof operation, ease of use, dependability and time saving.

That's why four out of five plants adopt Air-O-chek Air Guns as standard after a comprehensive test.

Try it. Install a dozen Air-O-cheks and compare results with the best you ever had.

Prompt delivery on high priority. Sizes for all requirements. Catalog on request.

AIR-WAY PUMP & EQUIPMENT COMPANY, 411 S. Jefferson St., Chicago 7, Ill.

CERROSAFE *Makes Wood Patterns and Core Boxes* LAST LONGER

Cerrosafe, melting range—160°-190° F., can be sprayed on wood patterns and core boxes by means of an electrically heated spray-gun.* This coating resists moisture, wear, and prevents warpage. Simplifies alteration of patterns.

Cerrosafe, when cast or sprayed, reproduces fine detail. Used for making duplicate patterns and as master models for engraving machines with low stylus pressures.

*Spray-gun information sent on request.

OTHER LOW-TEMPERATURE-MELTING ALLOYS

Cerrobase	**Melting Temp. 255° F.**
Cerrobend	**Melting Temp. 158° F.**
Cerromatrix	**Melting Range 217° F.-440° F.**
Cerrotru	**Melting Temp. 281° F.**
Cerrolow-117	**Melting Temp. 117° F.**
Cerrolow-136	**Melting Temp. 136° F.**
Cerroseal	**Melting Temp. 255° F.**

CERROLOW 117° F.—CERROLOW 130° F. and CERROLOW 174° F.

Write for name of nearest distributor

CERRO DE PASCO COPPER CORPORATION

40 Wall St. **New York 5, New York**

PROGRESS ON PARADE

Use our postage-free Inform-A-Gram for your requests.

FLEXIBLE PLUG GAGE HANDLES speed up gaging operations since the operator can approach the work within 20° of the hole axis and still obtain a perfect alignment of piece part and gage. With these handles, the added expense and limitations of a "leader" device on the gaging member is eliminated. In addition, the gaging member is relieved of handling abuse, and operator fatigue is reduced. The handle is lighter, so sensitivity to gaging operations is increased.

As shown in the photograph, positive identity of the "go" and "no go" gage ends is assured by the use of round and hex lock nuts respectively.

Complete specifications may be requested from SAPPHIRE PRODUCTS DIVISION of the ELGIN NATIONAL WATCH COMPANY, Plant No. 3, 932 Barton St., Aurora, Ill.

INFORM-A-GRAM KEY No. C89-M

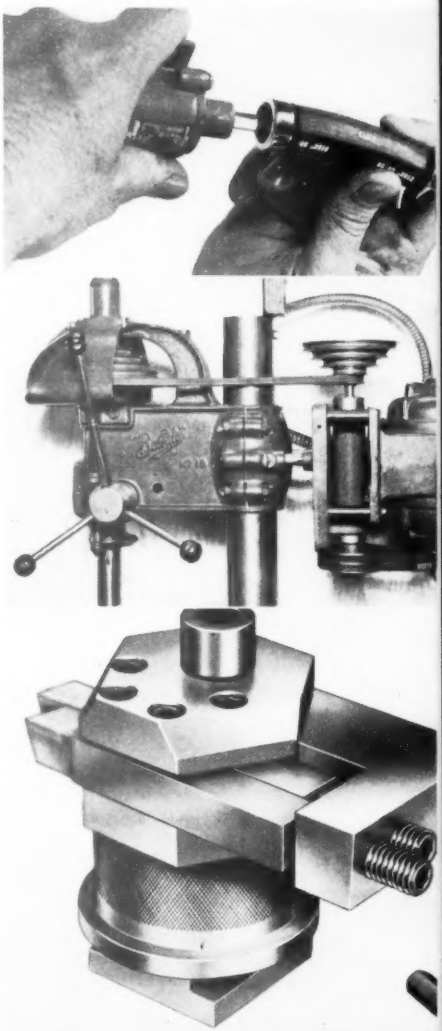
DRILL PRESS "SLO-DRIVE" increases the capacity and versatility of 18" to 20" popular make drill presses. This new Cardinal No. 18 Slo-Drive reduces the spindle speeds to a range which will accommodate drills and other tools up to one inch in diameter or larger. The actual speed reduction ratio is nearly 3:1 below the normal range of such machines.

It is a compact standardized unit which is easily installed on most makes of drill presses in this size range and will accommodate any motor. All the necessary parts required for installation are included in the unit. It is rated at 1 hp capacity and specifications include: alloy steel countershaft, heavy duty steel and semi-steel 2-groove pulleys, precision sealed ball bearings.

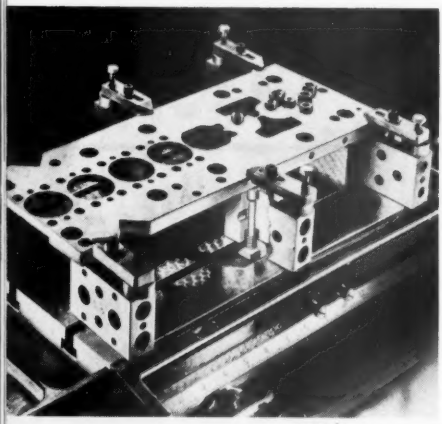
Complete information on this ruggedly constructed unit is available from CARDINAL MACHINE COMPANY, Dept. DJ, Glendale, Calif.

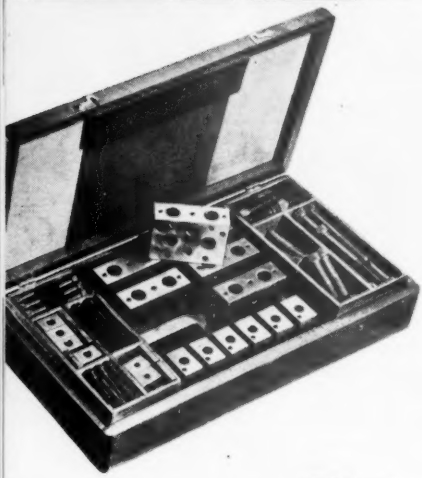
INFORM-A-GRAM KEY No. 226-M

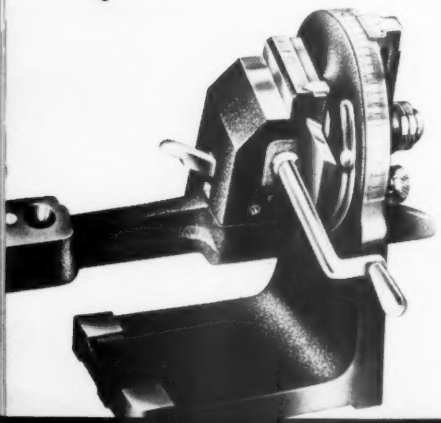
TOOL ADJUSTMENT BLOCK for use on Howard tool holders can be mounted on either side of the holder. It has set screws for adjusting either tool when combination tooling is used. The slot design facilitates changing tools or angle of tool setting without changing



PROGRESS ON PARADE







the position of the tool holder. The holder is easily installed for right- or left-hand turning or multiple changing.

On several tests using standard tool posts and holders, errors of .004" and .020" were cut to .001" and .005" respectively, when Howard tool holders and adjustment blocks were used.

HOWARD DEARBORN, INC., Dept. DJ, 3370 W. 140th St., Cleveland, Ohio, will send full particulars upon request, or use our

INFORM-A-GRAM KEY No. C68-M

3-WAY PARALLEL SETUP BLOCKS provide many advantages not found in conventional parallels. They are drilled and counterbored for bolting to the machine table or faceplate and will not slide off when attaching work to a vertical surface such as a micro-sine plate, a rotary table when used for radial spacing, or a lathe faceplate. They maintain uniform support, eliminate sagging, localize stresses and hold the work rigidly throughout the machining operation. The blocks may be placed to avoid interference with holes being bored or ground.

These blocks make excellent end stops or aligning stops for production jobs. They can also be used as angle irons or substituted for gage blocks, if too great dimensional accuracy is not required. They are precision manufactured from carburized chrome-nickel steel and finish-ground to tolerances of +.0002" —.0000". A set consists of six each of two sizes, 1" x 2" x 3", and ⅞" x 1¼" x 1½", packed in a mahogany box, with a large assortment of bolts and straps. Up to 12 different heights can be obtained with these two sizes.

MOORE SPECIAL TOOL COMPANY, INC., Dept. DJ, 726 Union Ave., Bridgeport 7, Conn., will send descriptive bulletin upon request.

INFORM-A-GRAM KEY No. 589-M

BLEY CONTOUR DRESSERS, manufactured by the Golconda Diamond Products Corp., have several features built into them insuring accurate reproduction of radius and tangent work. A taper bearing has been developed, consisting of two individual members, which permits adjustment and wear take-up for the life of the fixture. This bearing provides an accurate "no play" adjustment, and experience shows that this type of bearing also eliminates vibration.

Angulation work is accomplished by a carriage carrying the diamond supporting tool arm, which is fed crosswise in a conventional manner, much the same as on compounds of tool room lathes. A centering lever is provided, assuring that the carriage is always repositioned in the exact center of the slide on which the carriage travels, thus extremely accurate tangent work is produced.

The setting up of the Bley Contour Dresser is a very simple procedure and can be made at the bench before the fixture is placed on the grinding machine.

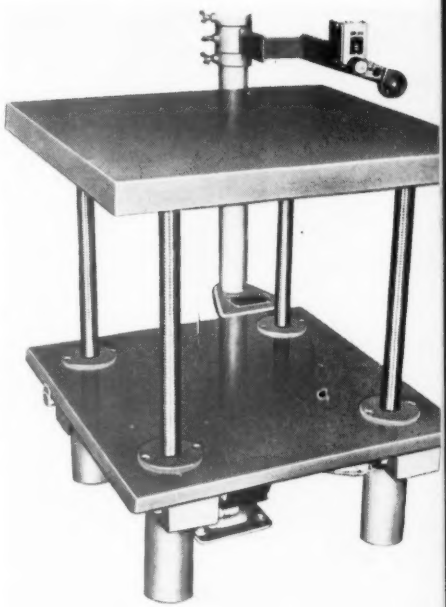
An important feature of this dresser is that the grinding wheel is dressed at the working point.

Further detailed specifications are available from GOLCONDA DIAMOND PRODUCTS CORP., Dept. TJ, 3418 No. Knox Ave., Chicago 41, Ill.

INFORM-A-GRAM KEY No. B12-M

AUTOMATIC STOCK POSITIONER is made up basically of the working elements of the "Portelvator", a portable table for handling heavy dies in and out of presses, transporting bulky work, etc. This new device will support a pile of sheet stock that is to be fed into a press, brake or shear. The table is lowered until the top of the pile of stock is at the most convenient height for feeding. As the stock is fed to the machine, the table rises at a rate that keeps the top of the diminishing stack always at the desired height. The electrical controls and motor that govern this movement are actuated by an arm and roller that "rides" on top of the pile.

Detailed specifications may be obtained from THE HAMILTON TOOL COMPANY, Dept. DJ, Ninth Street at Hanover, Hamilton, Ohio, or use our

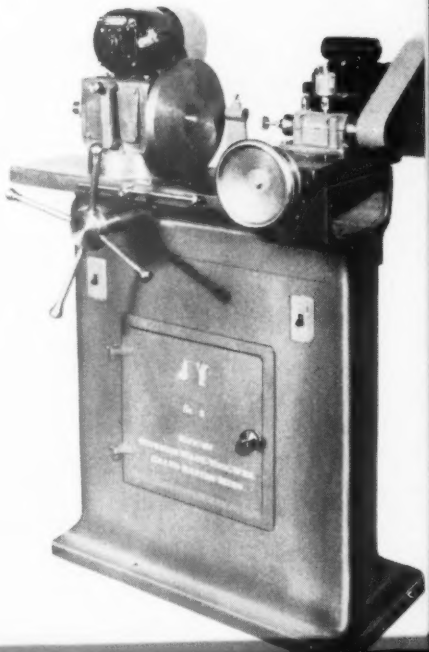


INFORM-A-GRAM KEY No. G61-M

PRECISION INTERNAL GRINDER is a modern machine tool especially designed to handle a wide range of tool room work, grinding anything from ¼" dia up, with absolute precision. It will accurately grind radii and tapers on any tool and die parts. It has a spindle speed of 12,000 to 27,000 rpm and a work head speed of 200 to 400 rpm.

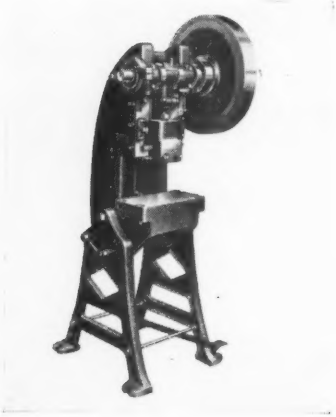
This grinder has a 10½" swing, with an 11" longitudinal travel. The 10½" faceplate with Heater controlled switches is standard. The machine does not have to be stopped to measure the work. Friction drive clutch and hand lever puts machine out of gear and applies brakes. The grinding spindle is driven by a ½ hp, 2450 rpm motor and the work spindle by a 1/6 hp, 1100 rpm motor. Both are dust proof and fully enclosed.

Full details may be obtained from SUPERIOR MACHINE & TOOL WORKS, Dept. DJ, 528 Butterworth St., S. W., Grand Rapids, Mich.



INFORM-A-GRAM KEY No. H72-M

INCLINABLE, OPEN-BACK POWER PRESSES feature a 6½" opening in the back of the frame and will incline 40°. The No. 12 press has a 12-ton capacity and a 1½" stroke, while the No. 14 has a 14-ton capacity with a 2" stroke. A stroke up to 3" is available for either press. The bed area is 8" x 15" and



the bed opening is 5" x 7" for both models. These new punch presses require only 28" x 28" floor space.

Additional literature may be obtained from DIAMOND MACHINE TOOL CO., Dept. DJ, 3429 E. Olympic Blvd., Los Angeles 23, Calif.

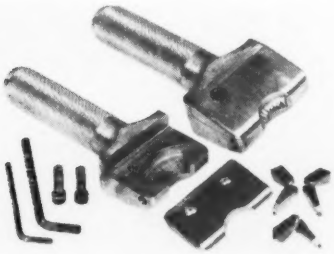
INFORM-A-GRAM KEY No. 268-M

CONVEX MARKING DEVICES will stamp dates, serial numbers, part numbers, etc., on solid round bar stock and parts. The interchangeable steel type are tapered to automatically form a pre-determined radius, and are held securely in place by a steel plate attached to the body of the holder with two set screws. This assures quick change and easy setup of the type.

Each piece of type bottoms securely against the hardened steel anvil of the type-holding recess, so that impressions of equal depth and clarity for all characters are assured with one blow of the hammer. The new marker is of semi-standard design, since parts to be marked having different radii require different holders and type. Type capacity can be readily varied by using spacers where full type capacity is not required.

NEW METHOD STEEL STAMPS, INC., Dept. DJ, 147 Jos. Campau, Detroit 7, Mich., will send complete specifications.

INFORM-A-GRAM KEY No. 122-M



NEW CENTERLESS LAPPING MACHINE brings to industry an advanced principle of lapping for the precision finishing of cylindrical pieces. A precision finish of less than 2 micro inches is easily obtained. One piece or a hundred are easily lapped without making setups, or using ring laps or other tools.

The manufacturer's experience in lapping many millions of plug gages, cylindrical parts and measuring wires, including the many small details which are important for obtaining accuracy and finish, has been built into this Model 100 centerless lapping machine.

The machine is furnished complete with a set of lapping rolls ground for precision work, a vibrationless drive, a ½ hp motor, 100 volt ac installed, a set of three lapping sticks, jar of lapping compound, and complete instructions. The cabinet is complete with coolant tray and lock.

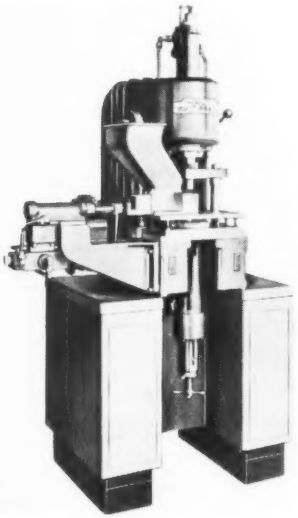
SIZE CONTROL CO., DIVISION OF AMERICAN MACHINE & GAGE CO., Dept. DJ, 4650 W. Fulton St., Chicago 44, Ill., will send Bulletin 446 upon request or use

INFORM-A-GRAM KEY No. F40-M

NEW SHUTTLE FEED ACCESSORY for use on their recently introduced Multipress has been announced by The Denison Engineering Company. This device greatly broadens the scope and utility of a multi-purpose small capacity hydraulic press. Powder pelleting is one of a wide variety of high speed produc-

tion jobs done on presses equipped with this accessory.

The Multipress unit used in setting up a pelleting machine has installed a hydraulic ejection cylinder and a hydraulic cylinder for actuation of a powder feed box. The press ram, ejection ram and feeding box ram are all positively interlocked. By means of a pre-adjustment of the press ram action, a "vibratory action" is provided to deliver 18 short full pressure loaded strokes in conjunction with each full stroke. The length of these short strokes may range from $\frac{1}{32}$" to ½". The maximum rate of ram travel is 200 ipm down and 300 ipm up. During the last two inches of ram stroke pressure downward, the speed can be reduced any place in the downward



range to 40 ipm. With this adjustment, a forming punch can approach a die rapidly, then be slowed down just as it enters the die.

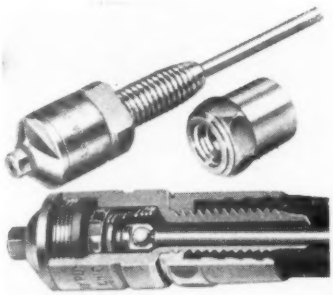
For more detailed information on this new accessory write THE DENISON ENGINEERING COMPANY, Dept. DJ, 1197 Dublin Rd., Columbus 16, Ohio, or use our

INFORM-A-GRAM KEY No. 260-M

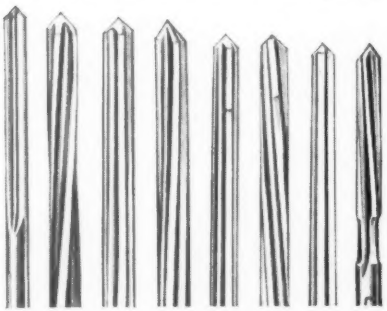
SCREW-ON FERRULE FOR AIR GUNS offers convenient and direct attachment to the air hose without the use of special tools. This is a new feature of Air-O-Chek, the streamlined air gun with ball and socket joint connecting an internal lever to the valve. The ferrule is slipped over the end of the hose and the threaded shank of the air gun is inserted into the hose and engaged with the threads in the ferrule. By screwing this up tight, the hose is compressed in a vice-like double grip between the serrations of the ferrule and the threads on the air gun shank. Wrenches are the only tools required to make this assembly completely free from protruding clamps and screws.

AIR-WAY PUMP & EQUIPMENT COMPANY, Dept. DJ, 411 S. Jefferson St., Chicago 7, Ill., will send complete details.

INFORM-A-GRAM KEY No. F12-M



GROUND FLUTE REAMERS for precision reaming, ground from the solid bar after hardening, have keen, long-lived cutting edges. They are distributed by LAVALLEE AND IDE, INC., Dept. TD, Chicopee, Mass. These small reamer specialists have eight popular types of ground flute reamers in their available stock including: straight and spiral fluted machine chucking reamers; straight and spiral rose chucking reamers; straight and spiral fluted hand reamers; and taper pin and stub screw machine reamers. The machine reamers range in size from $\frac{1}{16}$" to $\frac{5}{16}$" by $\frac{1}{64}$" steps. The available wire gage sizes include No. 1 through No. 60. The taper pin



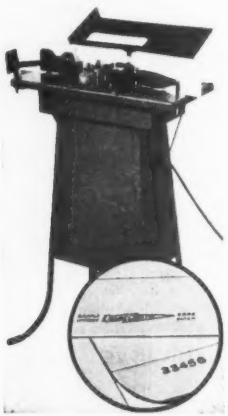
reamers stocked range in size from 7/0 to No. 4. Special model L & I ground flute reamers are also made to order. Grinding them from heat treated and uniformly hardened bar stock, produces the perfect cutting edges of L & I ground flute reamers.

INFORM-A-GRAM KEY No. 641-M

MARKOMATIC CODE DATER is an ingenious machine for the rapid and accurate marking of flat paste-end or tuck-in cartons, envelopes, bags, tabs and labels. A production rate of 10,000 to 12,000 cartons, 4½" long, can be achieved with this unit. Its separating section, when properly adjusted, will separate thin paper, thick cardboard cartons, or medium thickness bags without skipping. Either a sharp clear inked or a blind uninked debossed mark can be made on the cartons, bags, etc.

The unique method whereby the rotary die is started in motion and is prevented from making second impressions, regardless of the length of the object, is ideal for careful locations of impressions. Adjustments are easily made for varying the location of the mark. The metal type is interchangeable, so numbers may be changed in a few seconds.

The minimum length of items is 3" for one model and 4½" for another. There is no



reasonable restriction as to maximum length or width. This unit carries a one year machinery guarantee and no replacements except rubber rollers, ink and ink rollers are required for many years.

ADOLPH GOTTSCHO, INC., Dept. DJ, 190C Duane St., New York 13, N. Y., will send full specifications.

INFORM-A-GRAM KEY No. 44-M

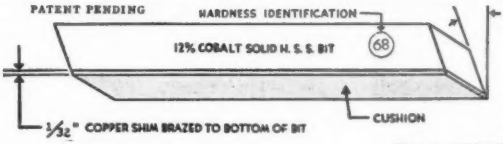
ELLSTROM MASTER GAGE BLOCKS are dimensionally accurate enough to suit a tool maker's standards, or plus or minus eight millionths of an inch. They are marketed by the DEARBORN GAGE CO., Dept. DJ, 22038 Beach St., Dearborn, Mich. This set of Ellstrom master gage blocks includes the following five sizes of blocks: .0625, .125, .250, .500, and 1.00". Though small, this gage block set produces as many as 31 dimensional combinations in $\frac{1}{16}$" steps ranging from $\frac{1}{16}$" to $1\frac{15}{16}$". A hand rubbed walnut case holds this set of master gage blocks, which have chromium plated gaging surfaces. The two formerly stocked sets of Ellstrom tool maker's gage blocks consisted of six pieces each and were made with either of two degrees of accuracy. Though this new set of five blocks is finished to such extreme accuracy, it is far more modestly priced than the other two sets.

INFORM-A-GRAM KEY No. 139-M

SAW-MATIC UNITS convert ordinary manual, metal cut-off saws to fully automatic operation. Saw-Matics are marketed by MACHINE SPECIALTIES, Dept. TJ, 4029 N. Kedzie Ave., Chicago 18, Ill. This unit is composed of: a pull-up device; a vise clamping mechanism; a saw lifting and lowering attachment; and a specially designed, super-sensitive, sawing length control valve. With exactness within .010", completely automatic cutting of $\frac{1}{16}$" lengths or greater is performed by the Saw-Matic. It regulates unattended long production run sawing so that the first and last pieces cut are of identical lengths. Such precision of cutting length is achieved by the special friction pull-up device with the extra sensitive valve. As little as 60 lbs psi compressed air pressure suffices for the unit's automatic operation. A special Saw-Matic unit is being built to fit each make of the most widely used metal cut-off saws.

INFORM-A-GRAM KEY No. G73-M

NOW—for the first time—a real GENERAL PURPOSE tool using the HIGHEST COBALT HIGH SPEED Steel . . .



65-68 Rockwell C Hard

PRICE LIST
Cushioned Solid 12% Cobalt H.S.S. Tool Bits

Size of Bit			In Lots of		
			1–9	10–49	50+
1/4	1/4	2 1/2	$ .60	$ .55	$ .50
5/16	5/16	2 1/2	.80	.75	.70
3/8	3/8	3	1.05	1.00	.95
7/16	7/16	3 1/2	1.45	1.40	1.35
1/2	1/2	4	2.00	1.95	1.90
9/16	9/16	4 1/2	3.10	3.05	3.00
3/4	3/4	5	4.60	4.50	4.40
7/8	7/8	6	7.20	7.10	7.00
1	1	7	10.20	10.10	10.00

The "cushion" does it—you get the extreme Rockwell and RED HARDNESS of 12% Cobalt H.S.S., plus an EFFECTIVE TOUGHNESS heretofore unobtainable with High Speed Steel Tools.

Gives production increases of from 20% to 200% through increases in speed and feed.

Ideal for shaper and planer work and interrupted cuts.

GUARANTEE: If not satisfied that this is the best GENERAL PURPOSE H.S.S. tool you have ever used—bits can be returned for full credit.

A trial will convince you.

WRITE FOR COMPLETE CIRCULAR

GENERAL TOOL & DIE COMPANY Inc.

555 Prospect St. *Phone: Orange 5-2500* East Orange, N. J.

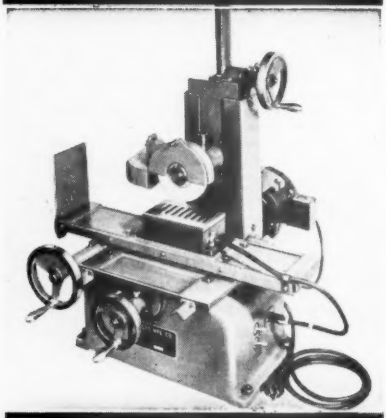
for **PEACETIME PROFITS**

With Dickerman Hitch Feeds for your punch presses, you'll get top production at rock-bottom cost. They are accurate, reliable and easily changed from one die to another. Send now for descriptive booklet.

DICKERMAN HITCH FEEDS

H. E. DICKERMAN MFG. CO., 321TD Albany St., Springfield, Mass.

SANFORD



High-Speed BENCH
SURFACE GRINDER

ACCURATE WITHIN .0001

A sensitive machine built to rigid standards of accuracy and workmanship specially designed *"For the job that fits in your palm."*

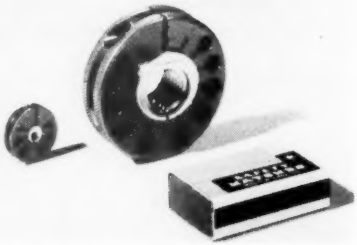
WRITE FOR BULLETIN

SANFORD MFG. CO.
1279-81 Springfield Ave.
Irvington II, N. J.

New Adjustable Thread Ring Gage

An advanced principle of design in adjustable thread ring gages provides greater accuracy and longer life. This unusual gaging instrument, introduced by the N. A. Woodworth Co., maintains roundness through the maximum range of adjustment. Since the wear is distributed over 360°, or the full thread, its wear life is increased from 2½ to 5 times that of the ordinary ring gage.

The gage is adjusted along the helix angle of the thread, preventing a jump lead at the adjusting slot of the gage. The aluminum alloy outer body reduces the weight 50% as compared to previous models. This lessens operator's fatigue, increases accurate inspection and



provides greater sensitivity. This gage employs traffic light signals for identification: green outer body for "go" and red for "no go". It cannot be thrown out of adjustment by ordinary blows or falls.

Write N. A. Woodworth Co., Dept. DJ, 1300 E. Nine Mile Rd., Detroit 20, Mich., for Folder 46R.

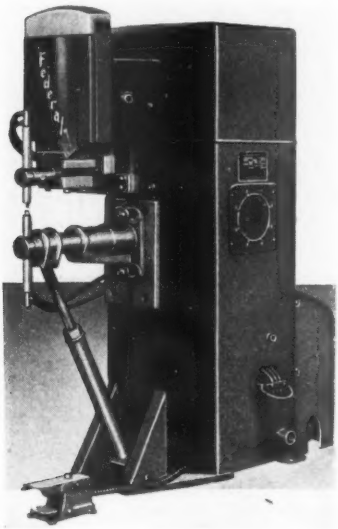
INFORM-A-GRAM KEY No. 926-M

Elected New Vice-President

Mr. J. A. Wagner, former vice-president of engineering and sales at Advance Tool and Die Co., was elected vice-president and manager of Sommer and Adams, Cleveland subsidiary of The Federal Machine and Welder Co. The completion and distribution of several postwar machines will be under his personal supervision.

Hydraulically Operated Spot or Projection Welder

This new automatic welder's pressure is applied through an inverted type hydraulic cylinder. Though this is part of the slide or ram, the upper end of the piston is secured to the welder top by a heavy transverse adjustable spring, which not only actuates the timing con-



trol switch for the welding stroke's fast follow up, but it also provides "reaction". After being set for a specific job, this welder requires operation of only one control, a foot switch. Jobs are easily positioned because of the flexible cable attachment of this switch, while a single light pressure and release produces a complete welding cycle. Welding speed is governed by timing controls, and automatic recycling continues as long as the switch contact is held. These 3 PH-1 series welders operate on 30, 50, or 75 KVA. Their capacities include sheets of steel or comparable material of from 6 to 26 gage. They are products of the Federal Machine and Welder Co., Dept. TJ, Warren, Ohio.

INFORM-A-GRAM KEY No. G64-M

3 NEW *Featherweight* KIPP AIR GRINDERS

MODEL JA
(Turbine Type Tool)—Takes Wheels Up To ⅞", Speed 50000 RPM, Collet ⅛",Weight 12 oz. Overall Length 6¾".

$29.75 IN U.S.A.

MODEL TT
(Turbine Type Tool)—Takes Wheels Up To 1¼", Speed 30000 RPM, Collet 15/64", Weight 2 lbs., Overall Length 9"

$39.75 IN U.S.A.

MODEL PVT
(Vane Type Tool) — A Power Tool For The Heavier Jobs Taking Wheels Up To 2½", Speed 10000 RPM, Collet 15/64", Weight 2 lbs. 4 oz., Overall Length 9".

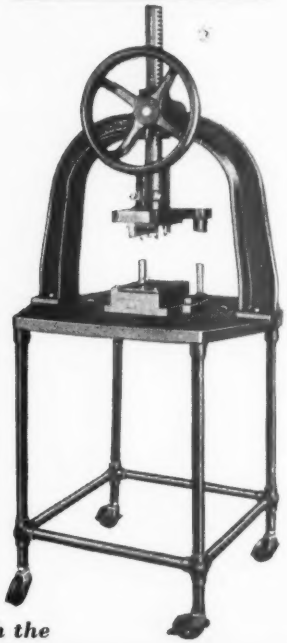
$49.75 IN U.S.A.

Order Now!

You now have your choice of three Featherweight Kipp Air Grinders as illustrated above. All three are available for immediate delivery and priced extremely low. Order today.

MADISON-KIPP CORPORATION
212 Waubesa St., Madison 4, Wis.

COMPLETE THE DIE-SET AT YOUR BENCH



with the

LACEY DIE-SET MACHINE

Here is a truly "one man" press that operates with one hand and under full manual and visual control.

Handy for tool and press rooms, it permits the diemaker to complete a die-set *right at his bench* . . . saves tool room and handling costs.

Positive, true punch-to-die alignment is assured at all times, thanks to the Lacey's sturdy, open construction. And punches can be removed as often as needed without disturbing alignment once the die-shoe is clamped to the table and punch holder fixed in position in the ram. No pry bar or hammer is needed to separate punches.

The Lacey Die-Set machine is sensitive for delicate work yet rugged enough for fitting up heavy die-sets. Useful, too, for shearing certain types of punches.

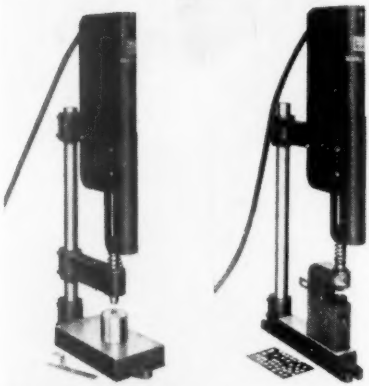
Write today for complete details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
740 Union Ave. Bridgeport 7, Conn.

New Impact Hammer

Multiple piercing of large, formed or unformed metal sheets is just one of the operations for which Air Impact Hammers have replaced larger, more expensive machinery. Holes spaced only 1¾", center to center, are pierced by the narrowest model of hammer. Used with standard units like Wales-Strippits, Air Impact Hammers punch practically any



work, and may be positioned various ways for piercing large, formed metal sheets. With pressure adjustability of from a minimum few ounces to 4000 lbs maximum, the ram is automatic in operation and regulatable to several blows ps. Piercing ⅜" holes in .065 cold rolled steel at 100 psi, is the hammer's capacity. It may have any one of three base sizes, depending upon required use or application. With suitable attachments, the Air Impact Hammer also upsets rivets; knife die blanks soft materials; performs light coining and forging; and stamps letters and numbers on plastics and other compositions as well as brass, aluminum, bronze and steel. Additional details about Air Impact Hammers are available from MEAD SPECIALTIES CO., Dept. TD, 4114 N. Knox Ave., Chicago 41, Ill.

INFORM-A-GRAM KEY No. 569-M

82-Piece Carbide Gage Block Set

With over 100 times the abrasive resistance of steel and 98 times the life of chrome plated gage blocks, Fonda tungsten-carbide gage blocks are practically wear-proof. In normal shop use they never need replacing or recalibrating. So greatly do Fonda blocks exceed U. S. Bureau of Standards' quality, that laboratory tests indicate they will wear less in 33 years of service than steel blocks do with 4 months' use. In this 82-C set, the blocks range in size from .050 to 4.00". They include: 9 pieces of .0001" steps from .1001 to .1009"; 49 pieces in .001" steps from .101 to .149"; 19 pieces in .050" steps from .050 to .950"; 4 blocks of 1", 2", 3", and 4" respectively; and one (1) piece of .10005". Their grade accuracy is as follows: "AA", plus or minus .000002"; "A", plus or minus .000004"; and "B", plus or minus .000008". Every Fonda gage block is even more durable due to its Fonda "Ultra Finish" of .2 to .4 micro-inch, rms. For wringing force

of adhesion, there is no comparison between these and those of other materials. Their dimensions, flatness, and parallelism are never altered for their growing or shrinking is permanently prevented by the tungsten-carbide's inherent stability. Bulletins fully descriptive of Fonda tungsten-carbide gage blocks are available by addressing Fonda Gage Company, Dept. TJ, 59 Daly St., Stamford, Conn., or use our

INFORM-A-GRAM KEY No. 998-M

Handiest Machine In The Shop

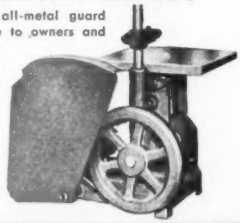
Reciprocal Filing at its Best . . . .

The simplicity and efficiency of the MILWAUKEE Die Filer provides maximum benefits from reciprocal filing. It permits quick, accurate set-ups, instant inspection of internal filing or sawing operations, quick inter-changing of files, lapping-stone or saws.

With its 1½" stroke, at its proper rated speeds, the Milwaukee does work equal to that of larger, costlier machines on a wide variety of filing, sawing and lapping jobs!

New DRIVE-GUARD FOR EXTRA SAFETY

This one-piece, all-metal guard is now available to owners and purchasers of the Milwaukee Die Filer, at slight extra cost. Easily installed, it provides complete protection for workmen, does not interfere with speedy shifting of drive belt.



Milwaukee
CHAPLET & MANUFACTURING CO.
1029 S. 40th ST., MILWAUKEE 4, WIS.

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ALVORD-POLK CUTTING TOOLS

REAMERS • MILLING CUTTERS • END MILLS

Standards and Specials delivered to meet YOUR production schedules.

Workmanship backed by more than 60 years of cutting tool engineering.

Territories open for Manufacturers Agents

Write for Catalog No. 16

ALVORD-POLK TOOL CO.

Millersburg **Pennsylvania**

CRITERION *Boring Heads*

Original Accuracy *Maintained*

Noted for maintaining original accuracy over a longer period- Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

Lead Screw ground from solid AFTER hardening.

CRITERION MACHINE WORKS

BEVERLY HILLS, CALIFORNIA

SHOP AIDS

For You And Your Job

Use our postage-free Inform-a-Gram for your requests.

KETOS DATA SHEET. The increased and continued use of Ketos has demonstrated its superiority in the field of oil hardening non-deforming tool steels. This steel may be hardened from fairly low temperatures with minimum volume change.

This data sheet contains information on forging, normalizing, annealing, hardening and tempering. A table of hardness values, as well as size change and toughness charts are shown. A list of the typical applications of Ketos tool steel is also given.

Copies may be obtained from the Crucible Steel Company of America, Dept. DJ, 405 Lexington Ave., New York 17, N. Y.

INFORM-A-GRAM KEY No. 256-M

"SELECTRODE CHART". This colorful chart guides electrode users in the choice of the correct electrode for a specific job. It tells which electrode to use, suggests applications, shows currents, positions, physical characteristics, etc. It also includes the electrodes recommended for mild, low alloy and stainless steels, non-ferrous and cast iron, surfacing, as well as gas welding rods.

A copy of this chart may be obtained from the Hollop Corporation, Dept. DJ, 4700 W. 19th St., Chicago, Illinois, or use our

INFORM-A-GRAM KEY No. H51-M

"SWAGING", the new 16mm sound movie, was produced for the information of tool engineers and for educational, employer and employee groups. It has proven invaluable in the improvement of the industrial application of the forming method of metal processing. It gives a 26-minute portrayal of the many applications of the "swaging process" in today's mass production methods for pointing, shaping, and attaching fittings to bar, cable and tube.

Steel, stainless steel, copper, aluminum and wood products can be included within the processing scope of the Swager.

It features the one operation—fast, precision, no scrap—forming type of manufacture.

The Standard Machinery Company, Dept. DJ, Providence 7, R. I., will forward further information, or use our

INFORM-A-GRAM KEY No. F30-M

"FEED AND SPEED CALCULATOR". This ingenious new slide-rule device will prove a valuable aid to machinists for calculating the proper "feed" per tooth per revolution for all types of carbide milling cutters. It also gives the suggested rate of speed for rough and finish cuts for many different kinds of materials.

The reverse side of the calculator shows the relation of revolutions per minute on the cutter head, and the surface speed in feet per minute, with the diameter of the work. A table of the decimal equivalents of fractions is also printed on it.

This calculator is available from Wendt-Sonis Company, Dept. DJ, Hannibal, Mo. Price, 25 cents.

"TAILORING IN METAL". The purpose of this new engineering manual is to help determine what products can be welded advantageously, to provide design information for improvement of quality and to effect fabricating economy. Various types of welds are explained and how they affect static and fatigue load values. The specific information about devices which can be employed to reduce cost and improve construction should be of particular interest to the designer. The methods are profusely illustrated with drawings and photographs.

Copies may be requested from Louis T. Kenney, Vice Pres., The United Welding Co., Dept. DJ, Middletown, Ohio.

INFORM-A-GRAM KEY No. 506-M

HYDRAULIC SUGGESTION SKETCHES. These three pamphlets offer design suggestions for hydraulic equipment. Sketch No. 1 features a suggested "Panel Box" for hydraulic control units. This panel box is provided either in the machine base or column, and hinged doors with locks prevent unauthorized tampering. Flow control valves with gasket mountings are also discussed.

Sketch No. 2 describes a design possibility for the location and construction of hydraulic oil reservoirs. The pump and drive motor, mounted on a tank base, are placed in the machine column or base. It is easily removable as a unit for cleaning or maintenance.

SHOP AIDS

Where there is insufficient room inside the machine base or column, a self-contained hydraulic power unit may be mounted independently at the rear of the machine.

Sealing and piping problems are discussed in Sketch No. 3. Gasket connections and mountings are fully described. The advantages of Vickerseals, designed for the particular conditions encountered in oil hydraulic systems, is also explained.

Copies of these three suggestion sketches are available from Vickers Incorporated, Dept. DJ, Detroit, Mich.

INFORM-A-GRAM KEY No. H47-M

POWER BRUSHES. This 24-page booklet was designed to serve as a virtual encyclopedia of power brush usage in manufacturing operations. Fifteen separate tables give detailed information on a variety of factors entering into efficient power brushing operation. For example, one table lists six elements which can be varied to modify brushing characteristics and shows the average effect of independently increasing or decreasing these listed factors. Another table deals with a list of brush types and information needed to make a tentative selection of a brush for an initial trial. Other tables go into the subject of adjustments, one on removing burrs, another on surface finishing and numerous others which discuss equally important power brushing problems.

A series of eleven tables group the various types of Osborn brushes and wheels.

This booklet, "How To Select Power Brushes for Manufacturing Operations", is available from The Osborn Manufacturing Company, Dept. DJ, 5401 Hamilton Ave., Cleveland 14, Ohio.

INFORM-A-GRAM KEY No. 417-M

"WELDING AND BRAZING OF COPPER AND COPPER ALLOYS" is a comprehensive treatise on procedures and materials. In the first section of this handbook are found definitions of materials and processes, a table of properties, recommended practices chart, joint design, preparation of material, and jigs and fixtures. The second section discusses each of the common copper alloys individually, while the last section is devoted to welding and brazing materials.

The text of this book does not attempt to establish any one process as preferable for all copper alloys, but rather makes it a point to study each alloy and select the process which promises the best results.

This 32-page handbook may be obtained from C. E. Phillips & Company, Dept. DJ, 2750 Poplar St., Detroit 8, Mich.

INFORM-A-GRAM KEY No. A34-M

"HOW TO CUT CAST IRON" is an illustrated circular completely covering the "how-to" on cutting cast iron with the oxy-acetylene flame. For many years cast iron cutting was considered almost impossible, but now with proper apparatus and technique, the job can be done both successfully and economically.

A discussion of proper types of equipment, preheating conditions, cutting positions, need of adequate protective clothing, proper oxygen and acetylene pressures, etc., are included.

The Technical Service Department of the National Cylinder Gas Co., Dept. DJ, 205 W. Wacker Drive, Chicago 6, Ill., will send Circular N-606 upon request.

INFORM-A-GRAM KEY No. 133-M

THE EFFECT OF MOISTURE ON THE WORK VALUE OF GLUE-BONDED COATED ABRASIVES is the subject of a bulletin by E. B. Gallaher, M. E., prepared for the Clover Mfg. Co. Valuable data are presented, thru the use of charts, to show the cutting ability of glue-bonded coated abrasives under different relative humidity conditions. It has been determined that maximum production is attained at 50% relative humidity. Tests made with the same material and 80% relative humidity resulted in low production, low cutting rate, and stretch of backing. Low production also resulted with a low humidity of 18%. Because of the dehydrating effect of the low humidity, there was a shedding of the grit, causing rapid failure of the belt.

Recommendations are made in the bulletin for the storing of abrasives in controlled humidifying rooms.

This Bulletin No. 5 is available on request from the Clover Mfg. Co., Dept. TD, Norwalk, Conn.

INFORM-A-GRAM KEY No. E34-M

PRECISION CASTING techniques and procedures as practiced at Haynes Stellite Co. are outlined in a brochure just published. Line drawings and photographs illustrate a variety of products cast by "the lost wax" process or "investment casting" method. These are all intricate parts which are produced more economically than by other methods.

The procedure in casting aircraft supercharger buckets is followed through step by step with photographs showing the different operations starting with the master pattern through to the finishing operation.

Parts made by the Haynes Precision Casting method are cast close-to-size, so that little or no subsequent machining or grinding is required.

Copies of Haynes Precision Castings will be sent on request from Haynes Stellite Company, Unit of Union Carbide and Carbon Corp., Dept. TD, Kokomo, Ind.

INFORM-A-GRAM KEY No. 313-M

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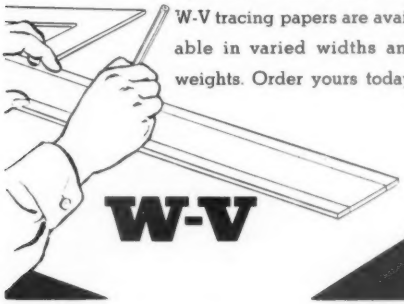

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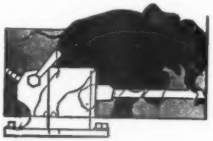
Presents The COLUMN PRESS

The new Mead Column Press delivers a ram pressure of 3000 lbs. on 110 lb. line air pressure and is especially useful for small to medium runs where it is desirable to leave fixtures permanently mounted to base. Successive operations are quickly performed in this manner; swing ram over desired fixture, raise or lower to correct height by the raising screw, lock in place with the two draw-bolts. In general, it is desirable that fixtures be "self-sufficient," requiring only the pressure of the plain ram to complete the operation. This eliminates need for attaching dies, punches, etc., to ram for each new operation. Completely described in the new Mead AIR POWER Catalog of Air Clamps, Air Vises, Air Presses, Work Feeders, Valves, Controls, etc. Send for copy.



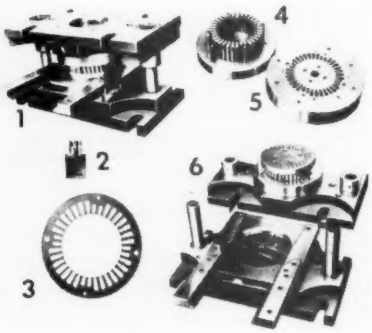
AIR POWER

MEAD SPECIALTIES COMPANY

4114 NORTH KNOX AVENUE, DEPT. HA-66, CHICAGO 41, ILLINOIS

Segmental Type Lamination Dies

The segmental type lamination dies, designed by the Crescent Tool and Die Company, feature removable and replaceable punches and segments. This



removable feature eliminates the necessity of replacing the entire punch build-up when one or more segments become worn. Since only the worn pieces need to be replaced, this means considerable savings to the user.

The illustration shows (1) front view of the die assembled, (2) die segments shown on block, (3) the stator lamination, (4) punch build-up, (5) die build-up, and (6) complete assembly in open position.

In addition to precision made dies, Crescent maintains extensive facilities for the design and manufacture of a wide variety of tools, fixtures, and gages exactly to the customer's specifications. A complete line of standard plug, ring, flat plug, profile, flush pin, snap, and built-up gages—all conforming strictly to the latest American Gage Design Standards—is also available. Gages are furnished with or without carbide inserts and chromium plating.

Complete information on the Crescent products and manufacturing facilities is available in illustrated form from the Crescent Tool & Die Company, Dept. DJ, 1780 Southfield Road, Lincoln Park, Michigan, or use our postage-free

INFORM-A-GRAM KEY No. C13-M

TEMCO ELECTRIC FURNACE

MODEL GRP

HANDY
PORTABLE
FAST HEATING
UNIFORM TEMPERATURE

FAST HEATING—1500° F. in 30 min. Temperature controlled by four point switch set for 500°, 1000°, 1500° and 1850° F. These settings easily changed by adjusting bands on rheostat coils. Dependable indicating pyrometer is calibrated in both Fahrenheit and Centigrade scales.

UNIFORM TEMPERATURE—Heating element of highest quality nickel-chromium alloy forms a continuous coil and is embedded in sides, top and bottom of muffle chamber. This construction assures uniform temperature and protects element from damage and oxidation. Complete muffle unit is replaceable.

PORTABLE—Body is aluminum. Total weight, 17 lbs. Muffle chamber, 4" x 3¾" x 3¾"; furnace overall, 9¼" x 13½" x 10½". Supplied with attachment cord. Operates on A.C. and D.C., 115 or 230 V. (*be sure to specify voltage*). Max. power consumption 1200 watts.

Model GRP complete, 115 V.....$42.50
Model GRP complete, 230 V..... 47.50

Larger models available
See your supply house or write

THERMO ELECTRIC MFG. CO., 474 W. Locust St., Dubuque, Ia.

Supplementary Information on Precision Truer

The typical face plate setup, illustrated here, shows a workpiece (25) located on the face plate (24) for centering. A deep centerpunch mark is sufficient to work from. A lathe center (26) whose back end is secured to another center (27) is inserted in the tailstock (28). The lathe is run at about 600 rpm. The follower (29) is moved slowly

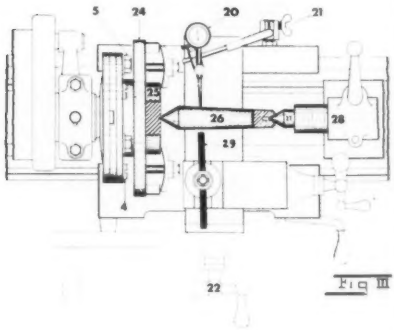


Fig III

against the center (26) until the indicator (20) stands still. The machine is stopped gently and the hexagonal screws (5) carefully tightened. Then the center (26) is removed. To center large holes or bores by this method, use a ball bearing bull center in place of the center (26). This method is especially practical when chucks are used.

Except for very precise work, the test indicator is not always necessary. The work can be centered to a very close tolerance by sighting through between the work and the follower to a piece of white paper placed under the work. An indicator holder (21) is supplied upon request. To install the indicator holder, drill a $\frac{5}{16}$" hole into the rear of the carriage, tap for 3/8-16 thread and attach the holder.

Mackay Machines Mfg. & Sales Corp., Dept. DJ, 1047-53 Forty-Seventh Road, Long Island City, N. Y., will furnish additional information upon request, or use our postage-free

INFORM-A-GRAM KEY No. G25-M

YOU DON'T BORE A HOLE THROUGH A DOUGHNUT— *The hole's already there!*

And the "hole's already there" in BISCO TOOL STEEL TUBING. So when you make circular tools or parts with a hole in the center—such as dies, punches, slitters, sleeves, bushings, collets, cams—saw off a piece of TOOL STEEL TUBING and the tool is finished except for final machining. TUBING saves 30% to 60% by weight and up to 80% of machining cost—and there is no scrap. Sawing is cheaper than boring.

The NEW BISCO Book is on the press. It contains information on all BISCO products, Carbon and Alloy Steels, HR and CD • Cold Finished Steels • Cumberland Ground Shafts • Drill Rods • Shim Steel • Spring Steels • Tool Steels and Tool Steel Tubing.

The Bissett Steel Co. TD
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Cleveland 8, Ohio
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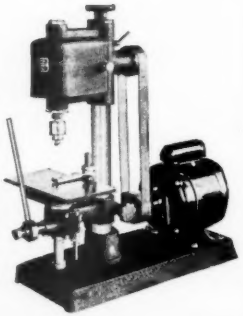
THE BISSETT STEEL CO.
945 EAST 67th ST., CLEVELAND 8, OHIO

TAPPING CAN BE *Fun*

When tap breakage is reduced to an insignificant minimum; when spoilage is eliminated and more and more work "passes inspection"; when you standardize on the Hamilton Sensitive Tapping Machine, **tapping can be fun.** • Precision built by a firm that **knows** precision methods, this machine is yet rugged enough to take all of the abuse that intense production can inflict. • Capacity from the smallest and finest tap to 10-32 inclusive. Ample clearances and travel. **And** an attractive price. • Write for literature containing specifications and prices. Address Department C-T.



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TAPPING MACHINES - PORTELVATORS

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WHEN YOU WANT *Standard* REAMERS . . . *the following sizes are carried in stock . . .*

Straight Shank, Straight Flute, Chucking Reamers

Dia.	Flute Lgth.	O/A Lgth.	Dia. Shank	List Price
1/32	7/8	2-1/2	1/32	$5.00
3/64	7/8	2-1/2	3/64	4.00
1/16	7/8	2-1/2	1/16	3.00
5/64	7/8	2-1/2	5/64	2.75
3/32	7/8	3	3/32	2.50
7/64	7/8	3	7/64	2.25
1/8	7/8	3-1/2	7/64	2.00
9/64	7/8	3-1/2	1/8	2.50
5/32	1	4	9/64	2.50
11/64	1	4	5/32	2.50
3/16	1-1/8	4-1/2	11/64	2.50
13/64	1-1/8	4-1/2	3/16	3.00
7/32	1-1/4	5	13/64	3.00
15/64	1-1/4	5	7/32	3.00
1/4	1-1/2	6	15/64	3.00
17/64	1-1/2	6	1/4	3.25
9/32	1-1/2	6	17/64	3.25
19/64	1-1/2	6	9/32	3.25
5/16	1-1/2	6	19/64	3.25

Above subject to 60% discount

Straight Shank, Spiral Flute, Chucking Reamers

Dia.	Flute Lgth.	O/A Lgth.	Dia. Shank	List Price
3/32	7/8	3	3/32	$2.50
1/8	7/8	3-1/2	7/64	2.20
5/32	1	4	9/64	2.75
3/16	1-1/8	4-1/2	11/64	2.75
7/32	1-1/4	5	13/64	3.30
1/4	1-1/2	6	15/64	3.30
9/32	1-1/2	6	17/64	3.60
5/16	1-1/2	6	19/64	3.60

Above subject to 50% discount

Also Designers and Builders of "SPECIAL" GUILD *Reamers*

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PUBLICATION PREVIEWS

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HIGH SPEED SURFACE GRINDING ATTACHMENT will save time and trouble on intricate grinding problems. With a small wheel of proper grit and bond, one can get sharp corners where needed and produce a fine finish so that no lapping is necessary and surfaces are left in perfect alignment, mechanically, with no hand work imperfections. Splines, keyways, etc can be ground close to flange shoulders. This attachment is provided with a rugged, trouble-free spindle rigidly carrying strong, capable wheel mounting quills so that every size and shape of wheel within the capacity of the device may be used. D & S MODEL CO., Dept. DJ, Dayton 3, Ohio, will send literature on this attachment. A booklet, "Useful Production Tools", by The Rieger Mfg. Co., describing circle cutters, multifacers, die holders, and spindle stops is also available from the D & S Model Co., who recently purchased The Rieger Mfg. Co., of Miamisburg, Ohio.

INFORM-A-GRAM KEY No. H75-M

PARALLELS IN SETS have many applications for every day use in the machine shop. They can be used to gage slots; grip shallow work close to the top of vise; raise work off table when drilling holes through work; or on a magnetic chuck to line up small work against back gage; etc. Sets are available in three standard sizes and are packaged in a wooden container with the size of each pair clearly marked. Additional information on these useful parallels is available from ANTON MACHINE WORKS, Dept. DJ, 52 Sands St., Brooklyn 1, N. Y.

INFORM-A-GRAM KEY No. H78-M

DIMINISHING ACTION LAPPING COMPOUND is a non-imbedding and self-reducing abrasive product which offers many important advantages to industry. It comes in a powder form, and is mixed with oil as used. When applied to parts to be fitted, it first acts as an abrasive, then its particles progressively diminish to a polish, finally to inert material with no further cutting action. It contains no emery, ground glass, silicon-carbide or similar substances. The use of Timesaver lapping compound results in a savings in time and labor ranging from 15% to 85%. It is available for either hard or soft metals. TIMESAVER PRODUCTS CO., Dept. DJ, 31 So. Desplaines St., Chicago 6, Ill., will send full particulars, or use our

INFORM-A-GRAM KEY No. H76-M

UNIVERSAL VISE will multiply the uses of standard machines for precision angle work and solve many manpower problems with its wide range of 3-way adjustments. Difficult compound angle setups are made in a fraction of the time usually required. The vise with its angle setup can be transferred from one machine to another without disturbing the workpiece. Heavier angle cuts may be made because of the extreme rigidity of the vise. It simplifies compound angle milling, drilling, reaming, slotting, die sinking, grinding, filing, shaping, sawing, tool sharpening, etc. A folder showing various applications and giving specifications may be obtained from WESSON PRODUCTS CO., Dept. DJ, 709 Fisher Bldg., Detroit 2, Mich.

INFORM-A-GRAM KEY No. 710-M

TIMKEN STEELS & TUBES are described in a 68-page booklet. The first section demonstrates how their modern facilities, plus skilled personnel and a rigid system of quality control, combine to produce alloy steels of consistent quality thus assuring economical fabrication and dependability. The second section lists in detail the analysis, finishes and sizes in which alloy steels, seamless tubes, stainless steels and tool steels are available. Requests for this booklet should be addressed to TIMKEN ROLLER BEARING COMPANY, Steel & Tube Division, Dept. DJ, Canton 6, Ohio, or use

INFORM-A-GRAM KEY No. 573-M

ABRASIVE BELT GRINDERS for grinding, polishing, deburring, beveling, and similar operations on metal, plastics, ceramics, glass, wood, etc are announced by HAMMOND MACHINERY BUILDERS, INC., Dept. DJ, 1631 Douglas Ave., Kalamazoo 54, Mich. Their Wet-n-Dri Model VH-6WP can easily be changed from vertical to horizontal position by loosening one cap screw. Model 5 is equipped with two backstands, and Model F-2 is a flexible belt grinder which solves many troublesome problems in the grinding, deburring, etc of irregular shaped parts. Their Bulletin 310 gives complete details and specifications on these models as well as other abrasive belt grinders.

INFORM-A-GRAM KEY No. 95-M

COMPLETE TOOL ENGINEERING. The McKinney personnel is composed of several hundred skilled toolmakers and mechanics who are familiar with the latest developments in tooling requirements. Over forty engineers are available for tool designing and engineering. Their specified experience in designing and building special jigs, fixtures, dies, tools, gages, and special machines especially qualifies them to handle the most exacting tooling problems. An illustrated folder is available from THE McKINNEY TOOL & MFG. CO., Dept. DJ, 1673 Arabella Road, Cleveland 12, Ohio.

INFORM-A-GRAM KEY No. 957-M

ACCURATE MARKING OF METAL PARTS is assured when Mercury interchangeable type holders are used. Pressing a button and pulling back on the lock cover permits quick and easy type change. A small, curved slot in the type fits a corresponding ridge in the holder so all type must be correctly set before the holder can be closed. An illustrated and descriptive circular may be obtained from MERCURY METAL DIE & LETTER CO., INC., Dept. DJ, 546 East 16th St., Los Angeles 15, Calif.

INFORM-A-GRAM KEY No. 657-M

CONDENSED GUIDE TO HEAT TREATING is a "thumbnail" text embodying most of the subject matter, with proper definitions, to facilitate a better understanding of metallurgy terminology. This 20-page booklet contains general facts about heat treatment of metals, heat treatment by high frequency induction, brazing by induction heat, copper brazing by controlled hydrogen atmosphere, heat treating definitions and terms, SAE numbering of steels, elements in steel, characteristics of the most common principal elements in alloys, machine shop spark test, magnetic inspection of metals, hardness conversion table, temperature conversion table, and miscellaneous data for ready reference. EASTERN HEAT TREATING & BRAZING CORP., Dept. DJ, 250 West 54th St., New York 19, N. Y., will send this booklet upon request, or use our

INFORM-A-GRAM KEY No. H77-M

HIGH SPEED PRECISION DRILL PRESS has been engineered exclusively for profitable and accurate drilling of small holes. Built into a sturdy and compact unit, it is a tool combining essential features not found in any other drill press. Its basic simplicity has resulted in many outstanding features such as elimination of drill side play, low noise and vibration, maintenance of exact drill speed, and many other advantages. An illustrated folder giving complete construction details and specifications may be requested from THE ELECTRO-MECHANO CO., Dept. DJ, 261 East Erie St., Milwaukee 2, Wis.

INFORM-A-GRAM KEY No. H79-M

HYDRAULIC "ASSEMBLY" PRESSES, described in Bulletin PA-45, are designed to perform a wide range of assembly operations. In addition to specifications, dimensions and a description of the standard line of presses, this bulletin includes illustrations of the typical "Special" hydraulic assembly presses. Both vertical ram and angled ram types are shown in a series of action shots. One press combines hydraulic pressure with an impact mechanism, especially useful for the "setting" of sleeves, bushings, etc. Copies of this four-page bulletin may be obtained from COLONIAL BROACH COMPANY, Dept. DJ, Box 37, Harper Station, Detroit 13, Mich.

INFORM-A-GRAM KEY No. 26-M

ELECTRONIC TEMPERATURE CONTROL, the Multronic Capacitrol, is fully described and illustrated in Bulletin D4-2. This multi-position electronic pyrometer controller utilizes dual circuits to achieve flexibility in meeting a multitude of applications requiring instantaneous, accurate indication and control of temperatures, voltage, current, signalling, and similar variables in process industries. Two electronic controls operate in harmony but independently of each other to control the variable temperature, etc measured by an accurate indicator, integrally mounted within the same housing. Oscillating currents generated by the two electronic circuits flow between two independent sets of coils, each of which is mounted on its own setting index. The control systems do not hamper free motion of the indicating pointer, thus faster results are possible than with mechanical balancing or pneumatic type controls. WHEELCO INSTRUMENTS COMPANY, Dept. DJ, Harrison and Peoria Sts., Chicago 7, Ill., will send bulletin upon request.

INFORM-A-GRAM KEY No. H73-M

MADISON-KIPP LUBRICATOR, Model CV, in eight different models and sizes is described in Bulletin L-3105, issued by MADISON-KIPP CORPORATION, Dept. T-9, Madison 4, Wis. Model CV is adaptable to general lubricator applications although it is especially suited to supplying measured quantities of oil against high pressure. A minimum of accurately made working parts has been achieved in assembly of the Model CV pumping unit. The one-piece body is assurance against leakage and the fast plunger action decreases oil slippage and makes the Model CV suitable for high as well as low pressure service. Model CV, which is one of the six standard Madison-Kipp Lubricators, is designed throughout for the exacting requirements of high pressure service.

INFORM-A-GRAM KEY No. B86-M

PRECISE VARI-SPEED LATHE BULLETIN gives full details on the specifications and features of this new precision tool. This unit was designed for speed and precision in grinding, deburring, sharpening, finishing, and

polishing, as well as for hand milling with midget high-speed and carbide milling cutters. It is ideal for work on any small part or product made of steel, aluminum, iron, magnesium, bronze, brass, plastic or glass. PRECISE PRODUCTS COMPANY, Dept. DJ, 1341 Clark St., Racine, Wis., will send a copy of this bulletin upon request.

INFORM-A-GRAM KEY No. B21-M

NEWLY DESIGNED SQUARING SHEAR embodies many new improvements not found in similar machines. The machine has front and rear gages which can be quickly set for different sizes. Spring actuated holddown is furnished to clamp the material firmly to the bed. The all steel welded construction will give many years of service. The top knife bar is strongly braced to withstand strain and is provided with adjustable bronze gibs to compensate for wear. ACME EQUIPMENT COMPANY, Dept. DJ, 126-128 South Lincoln St., Chicago, Ill., will send complete specifications.

INFORM-A-GRAM KEY No. H74-M

ROLLER BUSHINGS, consisting of an outer race with a full complement of rollers assembled integrally and providing an entirely self-contained unit, are furnished either with or without inner races. The rollers are of the tapered end design, and all small trunnions or extensions are eliminated. Rollers and races are made of SAE 52100 steel, heat treated throughout and carefully finished to the highest possible standards of accuracy. A 20-page booklet giving complete engineering data, types of bushings and applications may be requested from ORANGE ROLLER BEARING CO., INC., Dept. DJ, Orange, N. J.

INFORM-A-GRAM KEY No. H81-M

KEARNEY & TRECKER GENERAL CATALOG No. E-53 contains 48 pages of descriptive literature on the various models of milling and boring machines, their attachments and accessories, as well as a short history of the company. Specifications and dimensions of all machines, including both English and metric descriptions, are presented in fine-line drawings and two-color tables. All types of machines are illustrated. Copies of this catalog may be obtained from KEARNEY & TRECKER CORPORATION, Dept. DJ, Milwaukee 14, Wis.

INFORM-A-GRAM KEY No. 592-M

DRILL CHIP BREAKER, described in Bulletin No. 28161, insures better, faster, safer, and more economical drilling. With this device, chips are broken into uniform, small cuttings that are easily carried up the flutes of the drill. Coolants can reach the tip of the drill and help retain its sharp edge. CONTINENTAL TOOL WORKS, Division of Ex-Cell-O Corporation, Dept. DJ, Detroit 6, Mich., will send this bulletin describing the numerous advantages of their chip breaker upon request, or use our

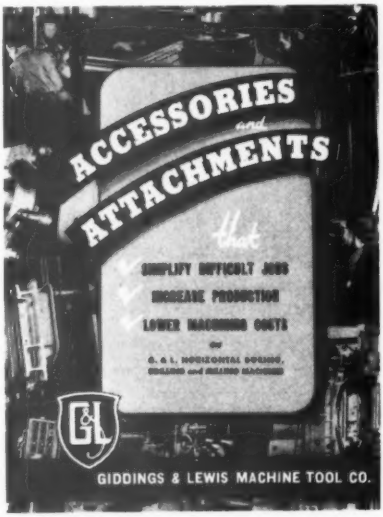
INFORM-A-GRAM KEY No. 737-M

CARBIDE TIPPED STANDARD TOOLS are described in a 16-page catalog by SUPER TOOL COMPANY, Dept. DJ, 21650 Hoover Rd., Detroit 13, Mich. It contains price lists, specifications, and recommendations for the types of materials each tool is best suited to machine. A table showing the feeds and speeds for end mills when machining various materials on the average milling machine should also prove helpful.

INFORM-A-GRAM KEY No. 160-M

GIDDINGS & LEWIS ACCESSORIES AND ATTACHMENTS are featured in a new 48-page book. Readers can instantly locate the most effective attachment or accessory for handling standard or complex jobs on Giddings & Lewis machines. Information is separated in box form on each page and tells how, when and where to use each item listed. Illustrations of the attachment are shown together with an actual operation photograph. More than 60 new or improved items, embodying the latest in engineering designs and features, are shown and each has a definite application to modern production methods. GIDDINGS & LEWIS MACHINE TOOL COMPANY, Dept. DJ, Fond du Lac, Wis., will send this book upon request.

INFORM-A-GRAM KEY No. 43-M



INDUSTRIAL DRILL ROD RACK holds 8 to 10 rods from 3" to 36" in length. It is clearly indexed with numbers or decimals from 1 to 60. This convenient rack saves time and

money and will last for years. Additional information is available from GRINDING SUPPLY COMPANY, Dept. DJ, 415 S. Western Ave., Chicago 12, Ill., or use our

INFORM-A-GRAM KEY No. H80-M

SUPERDRAULIC PUMPS are small enough to be held by a man yet capable of developing 5000 psi and 40 hp. Their delivery at 1200 rpm is 0 to 17 gpm. These radial type plunger pumps are available in two models, the constant delivery model and the variable delivery model. A folder containing diagrams and complete technical description may be requested from SUPERDRAULIC CORPORATION, Dept. DJ, Miller at Ford Road, Dearborn, Mich.

INFORM-A-GRAM KEY No. H82-M

CARBIDE TOOL GRINDER ATTACHMENTS increase the application range of the Hager carbide tool grinder. With these attach-

ments, milling cutters, counterbores, inserted tooth face mills, spiral reamers, end mills, and many other special type carbide tipped tools are easily and accurately ground. Engineered for flexible and simple setups, they assure constant and fixed control throughout the grinding operation, and enable the operator to work out innumerable arrangements to suit his individual requirements. A variety of typical setups utilizing these attachments is illustrated in an instructive booklet by E. F. HAGER & SON, Dept. DJ, 98-02 217th Lane, Queens Village 9, N. Y.

INFORM-A-GRAM KEY No. A64-M

INVARO BLANKING DIE STEEL for blanking, punching, piercing, forming, and any other operations requiring maintenance of extreme dimensional accuracy, are explained in bulletin SL 2003 by FIRTH-STERLING STEEL CO., Dept. T-5, McKeesport, Pa. Herein are presented in detail the characteristics and recommended applications of Invaro steel. Used in oil-hardening dies, it has initiated various economies in many plants supplying peacetime products at limited costs. High production at low cost is assured by the uniform hardness and long life of Invaro blanking die steel.

INFORM-A-GRAM KEY No. 10-M

INDUSTRIAL FLOOR MACHINES are illustrated and described in a new two-color bulletin by the G. H. TENNANT CO., Dept. T-5, 2530 Second St. North, Minneapolis 11, Minn. Featured herein are electric, self-propelling model "J" floor machines with 12" drum-type accessories. These machines are used for the removal of incrusted grime, dry cleaning, sweeping, polishing, burnishing, and sanding industrial floors. Tennant floor machines not only clean faster while cutting maintenance costs, they also greatly prolong floor life.

INFORM-A-GRAM KEY No. H33-M

IMPROVED POLISHING PRODUCTION effected through simplified operation is the subject of a booklet recently issued by BEHR-MANNING CORP., Division of Norton Co., Dept. T-3, 1933 Sidford St., Troy, N. Y. By use of factory coated abrasive belts and cushioned grind contact wheels, semi-skilled operators can turn out finished polishing work equal to that of skilled workers using less modern methods. More and better work than usual is accomplished by skilled polishers when they use this Behr-Manning polishing equipment.

INFORM-A-GRAM KEY No. 110-M

CLEAN OIL, Vol. 2, No. 1, featuring two each of new sump cleaners and coolant filters, has recently been issued by HONAN-CRANE CORP., Dept. T-2, 208 Indianapolis Ave., Lebanon, Ind. Herein is described how problems of oil purification encountered in a large cold-rolling mill were remedied by use of Honan-Crane equipment. Other topics treated include: recent years' developments in oil purification; present day application of this operating principle; and laboratory research as an agency for solving complicated problems presented by both the purification of oils and use of purified oils in modern industrial processes.

INFORM-A-GRAM KEY No. 322-M

THE A B C's OF ELECTRONIC HEATING including its principle, two main methods of application and their various uses are described in a booklet published by the Scientific Electric Div. of "S" CORRUGATED QUENCHED GAP CO., Dept. T-9, 107-119 Monroe St., Garfield, N. J. This 16-page booklet, which is addressed to engineers and manufacturers, brief-

ly presents the history and development of electronic heating. Herein are numerous texts clarifying illustrations with those of high frequency generators which are used for electronic heating.

INFORM-A-GRAM KEY No. D33-M

METAL MARKING EQUIPMENT FOR INDUSTRY is the subject of a new catalog issued by the WM. A. FORCE CO., Dept. T-9, 216 Nichols Ave., Brooklyn 8, N. Y. Within this catalog is shown a complete line of metal indenting, marking, and numbering machines. Other equipment includes steel type holders, steel stamps, detail presses, etc., for industrial uses. The products are illustrated, in many instances line drawings reveal their specifications and list prices are quoted. Upon request, this catalog will be sent to all who are interested.

INFORM-A-GRAM KEY No. 293-M

MAGNAFLUX INSPECTION equipment and methods, as well as their high efficiency in flaw finding, are described in literature available from MAGNAFLUX CORPORATION, Dept. T-7, 5900 Northwest Highway, Chicago, Ill. As originators and pioneers of this inspection method, Magnaflux Corporation and its engineering staff have accumulated an unequaled fund of specialized knowledge and experience concerning it. This is not only revealed by their publications, it is also placed at the disposal of industry in the service which they extend to Magnaflux users.

INFORM-A-GRAM KEY No. 375-M

A PRESSURE REGULATOR usable for suction or flow ratio in any gas or air flow system requiring accuracy of operation is known as the Type 2-SO regulator. It is featured in a bulletin by the CONTROL DIV. OF HAGAN CORP., Dept. T-7, Hagan Bldg., Pittsburgh, Penna. Herein is presented a cutaway, 3-color illustration clarifying the operation of this regulator which has a range of from 0.10 water column to 5 psi. It is used for industrial furnace, fuel air ratio control as well as that of any industrial process greatly affected by proportionate gas or air flow.

INFORM-A-GRAM KEY No. E68-M

ELECTRO-AIR CONTROL for converting standard machine tools and fixtures to automatic and semi-automatic production units is the subject of a new bulletin released by ELECTRO-AIR DEVICES CO., Dept. T-5, 2807-13 W. Fletcher St., Chicago 18, Ill. Used with any standard air cylinder, the new 24V control will provide either single or multiple cycle control with cycle timing, hesitation, limit switches, etc. By this means, automatic drilling, tapping, milling, indexing, and holding are among the wide variety of operations which may be performed.

INFORM-A-GRAM KEY No. H34-M

CRANK SHAPERS is the title of catalog No. 45, a completely explanatory publication distributed by THE SMITH AND MILLS CO., Dept. T-4, 2926 Spring Grove Ave., Cincinnati 25, Ohio. This catalog contains 24 pages of data, illustrations, drawings, and specifications concerning Smith and Mills 12", 16", 20", 25", 28", and 32" Crank Shapers. Page by page, each sub-assembly is shown in clear, easily understandable photos. With every one is a careful explanation of the mechanical design with reasons for its incorporation.

INFORM-A-GRAM KEY No. H1-M

AN EMPIRE LIVE CENTER fitted with a Jacobs chuck is a most effective tool for the precision machining of small diameter work. It is explained and illustrated in a new bulletin by ROYAL PRODUCTS, Dept. T-8, 68 Spring St., New York, N. Y. This special Empire Live Center is placed in the lathe tailstock while the small diameter work is tightened into the Jacobs chuck. Then turning the tailstock wheel opposite from a thrust direction to cause pulling action instead, holds the work rigid and straight and eliminates its tendency to "belly".

INFORM-A-GRAM KEY No. 721-M

SIL-FOS AND EASY-FLO preplacement for low temperature, silver alloy brazing, with its advantages and variety of applications, is well explained in a new folder by CHARLES W. KRIEG CO., Dept. T-5, 52-60 Dickerson St., Newark 4, N. J. By preplacing wire rings, washers, and cut strip or pieces of wire in or adjacent to a joint area, and brazing it with Sil-Fos or Easy-Flo, is a simple, effective procedure. This method of application combined with fast heating consistently produces strong, leak-proof joints at surprisingly low cost.

INFORM-A-GRAM KEY No. H55-M

STANDARDIZED CYLINDERS for air, oil, or water operation are announced by the ENGINEERING PRODUCTS CO., Dept. DJ, Los Angeles, Calif. This is a new type of service in cylinder construction, which lends itself to almost universal mounting applications. Completely uniform and manufactured in quantities, cylinders from stock include a wide assortment of diameters and stroke lengths. Thus they meet practically all cylinder requirements. Bulletin 453, issued by Engineering Products Co., describes heavy duty cylinders which assure their users of maximum endurance with the utmost freedom from trouble and repairs.

INFORM-A-GRAM KEY No. G77-M

UNIVERSAL GEAR CHECKERS are explained in detail and comprehensively illustrated in a new booklet issued by NATIONAL BROACH AND MACHINE CO., Dept. T-6, 5600 St. Jean, Detroit 13, Mich. Red Ring Universal Gear Checkers are made to maintain required mass production economies. Fundamentally simple in its construction and operation, this gear checker incorporates strength with consistent accuracy. Not only is it easy to set up

and fast in action, it is easily handled by any shop man who is familiar with gears.

INFORM-A-GRAM KEY No. A39-M

STROKE COUNTERS with built-in protection against the operating arm's over travel are announced by PRODUCTION INSTRUMENT CO., Dept. TD, 702-14 W. Jackson Blvd., Chicago 6, Ill. By working against a coil spring, the operating arm may continue beyond its full stroke length without injuring the counter. This arm may be installed on either side of the counter and set at any angle. Five large number wheels which register up to 99,999 and repeat, equip this device. Its smallness and completely enclosed, tamper-proof case render this stroke counter ideal for every built-in application.

INFORM-A-GRAM KEY No. G79-M

CONE DRIVE GEAR SETS, matched in 99 sizes and ratios, are listed as standard stock in catalog 700 published by MICHIGAN TOOL CO., Dept. T-6, 7171 E. McNichols Rd., Detroit 12, Mich. The center distances of these gear sets range from 2" to 18"; their ratios range from 5:1 to 70:1. The standards cover a range of from .06 hp at 100 rpm to 800 hp at 2400 rpm, based on class one service. Standardization of these gear sets has reduced costs, simplified ordering, expedited delivery and eliminated need of gear designing or calculating bearing sizes, locations, etc.

INFORM-A-GRAM KEY No. 47-M

NOX-RUST thin film rust preventives composed of a complete line for specific purposes are the subject of a bulletin issued by NOX-RUST CHEMICAL CORP., Dept. T-6, 2423-63 South Halstead St., Chicago 8, Ill. Moisture laden air, noxious gases, fingerprints, acids and corrosive chemicals are the insidious promoters of rust. Each one requires special agents, scientifically blended to overcome their rust promoting effects. Depending upon the type of application required, Nox-Rust coatings vary in degree of hardness and other physical qualities.

INFORM-A-GRAM KEY No. G74-M

MICRONOIL TAPPING LUBE for smooth, fast cutting at low temperature and tool cost is introduced in new literature published by PROTECTIVE COATINGS, INC., Dept. T-5, Detroit 27, Mich. Tapping always has been a headache, and an expensive one in the experience of a prominent Ohio firm. This long standing problem of performing accurate tapping at reasonable cost is effectively solved by use of Micronoil Tapping Lube. Tap breakage is practically eliminated by use of this newest "Product of Matchless Merit" made by Protective Coatings, Inc. They supply samples of the lubricant upon request.

INFORM-A-GRAM KEY No. 434-M

TESTING INSTRUMENTS are described and illustrated in a catalog recently released by STEEL CITY TESTING LABORATORY, Dept. T-6, 8843 Livernois Ave., Detroit 4, Mich. Herein are described six different Brinell testing machines including manually operated and portable types. Another one featured is a universal model which may be adapted to tensile, traverse, and compression tests up to 60,000 lbs. Besides manufacturing a complete line of testing equipment, this company maintains an engineering force to design and build special testing machines best suited to a user's specific requirements.

INFORM-A-GRAM KEY No. E79-M

DRYSEAL PIPE THREADS are now being used in place of all Weatherhead standard catalog Ermeto, Inverted, S. A. E. and compression tube fitting threads. A complete explanation of these threads and their advantages is presented in Form G-109, released by THE WEATHERHEAD CO., Dept. T-3, 300 E. 131 St., Cleveland 8, Ohio. Adopted by the automotive field as standard equipment, Dryseal Pipe Threads eliminate need for dope though they provide a tighter seal. This change does not apply to the standard pipe fittings mentioned on pages 14 and 15 of the Automotive and Industrial catalog, J-103-J, as well as "AN" and "ER" aviation fittings.

INFORM-A-GRAM KEY No. 101-M

PORTABLE INDUSTRIAL ELEVATING TABLE has proven to be a big labor saver in machine shops, tool rooms, punch and plastic molding die departments. It is made of steel and has a capacity of one ton. There is nothing to get out of order and it remains fixed in any position. It can be used to move heavy dies, support large overhanging pieces on drill presses, transfer work, etc.

Complete specifications on these handy tables are available from MONTGOMERY & CO., INC., Dept. DJ, 53 Park Place, New York 7, N. Y.

INFORM-A-GRAM KEY No. H89-M

GRIP-SLIDE, the new precision-built tool for threading and tapping, was designed to speed-up and improve external and internal threading on lathes. Its use does away with the slow, troublesome, old-fashioned methods and permits high cutting speeds, ease of operations, surprising accuracy and considerable savings in working time. Quarter-inch ring calibrations on the guide bar show when the desired length of thread has been cut. There is no lost time in shifting the tailstock or tailstock spindle. Die holder bores are concentric with and accurately fitted to the calibrated guide bar. Both the guide bar and sliding die holders are hardened and ground. Literature on this remarkable time-saving tool is available from THE THREAD MILLER CORPORATION, Dept. DJ, 17 East 42nd St., New York 17, N. Y., or use our

INFORM-A-GRAM KEY No. H88-M

A NEW DELLOY CATALOG, revised and enlarged, which features cutting tools, has just been issued by DELLOY METAL CORP., Dept. T-8, 1221 E. Erie Ave., Philadelphia 24, Pa. This fully illustrated catalog lists the types, sizes and prices of standard Delloy tools, tips, and bits. It also presents technical

information on the physical and mechanical properties of Delloy metals, a cutting speed chart, and specific data on form tools and precision castings. Shop men and metallurgists will find this catalog's contents extremely interesting as well as helpful.

INFORM-A-GRAM KEY No. H35-M

WELDCO COVERED ROLLS are featured in bulletin R-45, a recent publication of THE YOUNGSTOWN WELDING AND ENGINEERING CO., Dept. T-7, 3700 Oakwood Ave., Youngstown 9, Ohio. Bulletin R-45 contains 12 pages of illustrations on the recovering of rolls with nickel, nickel alloy, stainless steel, silicon, bronze, or other weldable alloys. These photos show how the rolls are covered, their industrial uses, pulp and paper mill applications, and a list of other Weldco products. Six roll covering operations plus actual installations now in use are also illustrated.

INFORM-A-GRAM KEY No. H37-M

DZUS FASTENER STUDS being installed by a new, 50 percent time reducing process is the topic of a booklet lately released by DZUS FASTENER CO., Dept. T-3, Babylon, L. I. In addition to saving time, this quicker, simpler method of installation greatly facilitates Dzus fastener use in mass production operations. It also simplifies field use replacement of these fastener studs. This booklet also describes Dzus fastener functions of various kinds and shows many typical applications of these fasteners.

INFORM-A-GRAM KEY No. H32-M

TORQUE THUMB SCREWS, Spring Plungers and Stops, and Milling Fixture Keys are products featured in a new bulletin by VLIER MANUFACTURING CO., Dept. T-7, 4552 Beverly Blvd., Los Angeles 4, Calif. The torque thumb screws have ratchet knobs which turn without advancing them, once the clamped parts are properly supported. Spring plungers provide positive action with low cost accuracy for punch and die or drill jig applications. Spring stops may be used wherever die designs leave no wall space for insertion of regular spring plungers. The universal milling fixture keys, though simple, embody features which cut manufacturing costs.

INFORM-A-GRAM KEY No. E51-M

A PORTABLE WELDING OUTFIT, the complete Magic Wand Welder with a convenient carrying case, is fully described in a folder by PATENT SPECIALTIES, INC., Dept. T-2, 4020 Tenth Ave., New York 34, N. Y. Welding, brazing, and contact soldering are all efficiently performed with this welder and the set's included supplies. Operating on AC, 110-V, 60-cycle current, the Magic Wand Welder is a valuable tool for home as well as shop use. This portable welding set promptly saves its users considerable time and labor through enabling them to bring the welder to the job, not the job to the welder.

INFORM-A-GRAM KEY No. H54-M

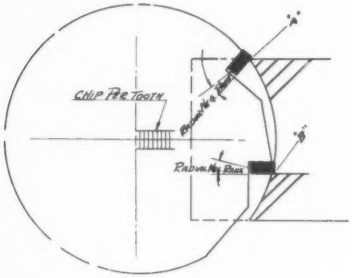
STAINLESS STEEL VALVES & FITTINGS which are certified bear permanent numbers corresponding to the steel's heat analysis registration number. This is the subject of a new folder issued by THE COOPER ALLOY FOUNDRY CO., Dept. T-3, Bloy St. and Ramsey Ave., Hillside, N. J. This line of Cooper Certified Stainless Steel Valves includes standard types of globe, gate, "Y", check, needle, and quick opening valves. Four of these many valves as well as a variety of fittings are shown by diagrams in the folder. Many advanced production methods used by this modern foundry are also listed.

INFORM-A-GRAM KEY No. H36-M

INDUSTRIAL DESIGN, its aspects and applications are the subjects of a bound portfolio of booklets and folders recently issued by I. GORDON LIPPINCOTT AND CO., Dept. T-3, 500 Fifth Ave., New York 18, N. Y. This literature includes examples of designer-client mutual publicity, outlines of industrial design as a profession, pamphlets on packaging, and a folio on the costs of industrial design.

INFORM-A-GRAM KEY No. H53-M

Fig. 12. Designing a cutter to get maximum efficiency from rake angle.



NOTE AT "A" CUTTING EDGE IS WELL PROTECTED BY NEGATIVE RADIAL RAKE

SHOULD THE TOOTH ENTER WORK AT "B" THE FACE OF THE TOOTH WOULD STRIKE FLAT AGAINST THE WORK

IN DESIGNING THE CUTTER THE NATURE OF THE CUT SHOULD HAVE MUCH TO DO WITH THE RAKE ANGLES

SEE SLOTTING CUTTER - SLIDE "T"

WHEN CONDITION SHOWN AT "B" EXISTS NEG RADIAL RAKE SHOULD BE CORRECTED

(CONTINUED FROM PAGE 87)

the cutter. Fig. 8 shows the arrangement for flywheel installation, and Fig. 5 shows this arrangement actually installed on an existing machine.

Method of Removing Chips From Cutter

In conventional milling, a coolant is generally used which, to a certain extent, washes the chips out of the cut and off

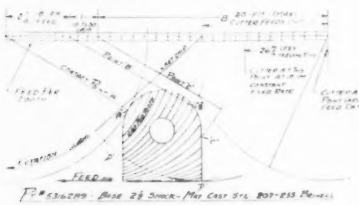
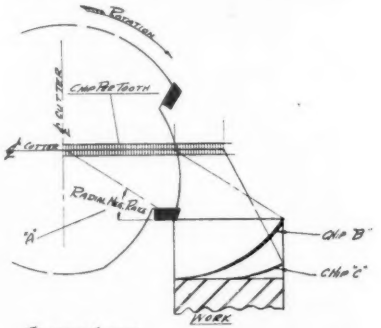


Fig. 13. Advantage of hydraulic feed using variable feed rates during the cycle.

the cutter, especially in the case of slotting or peripheral cuts.

As no coolant is used with carbide-tipped cutters, some of the chips cling to the teeth of the cutter and must be mashed in two, before the carbide presents its cutting edge to the work. This is very detrimental to the carbide. In some instances a blast of air is used to blow the chips from the teeth, but in some departments air is not available, and if it were, this practice is noisy, annoying, and expensive.

By mounting a round wire brush on a



SLOTTING CUTTER

NOTE THE EXTREME NEGATIVE RADIAL RAKE READ TO PROTECT CUTTING EDGE AT "A"

NOTE THE THINNESS OF CHIP "C" THIS CAUSES A RUBBING ACTION AND ABRASION ON THE PERIPHERY OF THE CUTTER

RAKE AND CLEARANCE MUST BE CONSIDERED ON THIS TYPE OF CUT

THE RAKE AND CLEARANCE SHOULD BE VARIABLE

Fig. 14. A condition that often arises in a slotting cut.

spindle so that the rotation of the cutter revolves the brush across the face of the teeth, it has been found possible to wipe the chips free from the carbides, doing a better, cleaner, and cheaper job than with air and without the nerve-racking noise. Fig. 6 shows the installation.

Carbide-Milling With Present Equipment

By adhering to the essential fundamentals of good milling practices, carbide-milling can be done on practically any machine in good condition, providing

the power required does not exceed the power of the machine. The smaller the power of the machine, the less the metal that can be removed. Cutting speeds and correct chips per tooth must be maintained. This means the cutter must be designed to fit the job, and feeds and speeds must not be altered by the operator (see Fig. 10).

From the example given in Fig. 10, it will be seen that many of the shortcomings of present equipment can be overcome by the proper selection of cutters. This will be discussed more fully with our experience in cutter design (see Fig. 11).

Cutter Design To Fit Present Equipment, Or Equipment Designed Especially For Carbide-Milling

Much truth may be spoken regarding cutter design, which will mean absolutely nothing if not put into practice. The following considerations always enter into the design of our cutters:

1. Material to be milled (this is an index to the grade of carbide to use and, to some degree, the rake angles).

2. Shape of the part to be milled, or the shape of the metal that is to be removed. This determines the type and size of cutter to be used. It has a very definite bearing on rake angles.

3. Width and depth of cut, material to be milled, and horsepower of mill are the deciding factors in number of cutter teeth.

4. After considering the material to be cut, the shape of the part, the width and depth of cut, and horsepower of machine, we should have a very definite idea of the cutter to be used.

5. So far, we have considered the cutter in relation to the job only, and we next consider the cutter from the construction-service viewpoint, Fig. 7, as follows:

Carbide should be away from body to prevent cracking.

Approximately 25 percent of the thickness of the carbide should overhang the body to facilitate grinding and to protect the cutter body.

Carbides are set in at 5° negative radial rake and ground to 10° negative

NEW GAGE SAVINGS!

SCHNACKE *Adjustable* FLUSH PIN GAGE

With this new adjustable gage, you can have an accurate Flush Pin Depth Gage quickly and save time and money. Serves many varied gaging purposes in production and inspection. Set consists of 3 interchangeable depth rods (1"—2"—3") and 1" diameter sliding anvil, adjustable to required depth. Sliding tolerance feelers at the top are set with micrometer screw from plus or minus .000 to .200. Locks firmly. Standard set applicable to any decimal dimension up to 3.00".

Special anvils and longer rods are also available. Write for descriptive circular.

SCHNACKE, INC.

1016 E. Columbia St. Evansville, Ind.

radial rake. This presents a narrower surface to the grinding wheel, evolves less heat while grinding, fewer teeth can crack, and nicks are easy to grind out.

By setting the teeth in as stated, we save grinding time on the face of the teeth.

Fig. 15. Part milled with the cycle shown in Fig. 13.

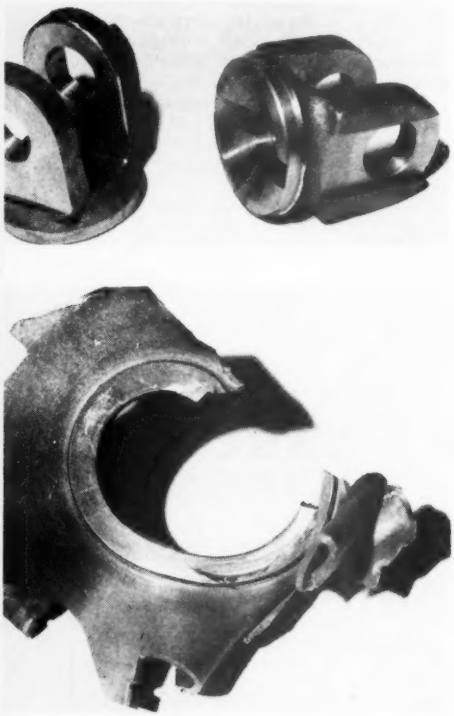


Fig. 16. Safety feature of narrow carbide cutters because of soft cutter body.

The primary land is $\frac{3}{32}$" which is much wider than the usual $\frac{1}{32}$". This aids the honing, as it is very difficult to hone a $\frac{1}{32}$" land on top of the tooth and keep it flat.

Fig. 9 shows a slotting saw for copper. Here, since it is very difficult to hold small pieces of carbide while brazing, we decided to use round carbide. By milling a round seat for the carbide, the problem of location was solved. A carbide nearly to size could be used, which cuts the grinding time to a minimum. Fig. 9 (a) shows a slotting cutter as it usually appears with rectangular carbides before grinding; Figure 9 (b) shows the round carbide.

Radial Rake. Radial rake protects the cutting edge and has much to do with the life of the cutter and should be determined from the material and the nature of the cut. It will be seen in Fig. 12 that when the tooth enters the work at point A and cuts from point A to point B, the cutting edge is well protected and would not require as much negative radial rake as a tooth entering the work at point B.

Fig 14 shows a slotting cut. This type of cut requires more negative radial rake than the cut shown in Fig. 12.

Axial Rake. Axial rake protects both the cutting edge and the point of the tooth, but not to the same degree as the negative radial rake. The material, the nature of the cut, and the depth of cut should control the axial rake angle.

Cutting Speeds. As previously mentioned, the essentials of good milling practice are more exacting in carbide-tipped milling than in conventional milling. The correct cutting speed for the material to be milled heads the list. Practically all research on the matter and experience indicate that too high a rate of cutting speed leads to short cutter life. Charts showing recommended cutting speeds for various materials have been published by the Cincinnati Milling Machine Company, and these speeds in our experience have proved to be substantially correct. The most important factor in selecting cutting speed is to know your material.

Feeds. The rate of feed should be determined by the number of teeth in the cutter and the revolutions per minute of the spindle.

The feeding mechanism itself should be smooth and free of backlash. This is very essential in a slotting cut, as the cutter tends to drag the work in. For carbide-milling, hydraulic feed is ideal. On conventional milling, objection to hydraulic feed has been raised because

the feed increases as the oil warms up. In a case where the feed rate is 2 ipm in conventional milling and some slight increase in the oil being metered out causes the feed rate to go to 3 ipm, an increase of 50 percent in the feed will have occurred. Where carbide-milling is involved, the feed rate is always high, usually 20 ipm or more, so that a slight increase in metering, due to change in oil viscosity, would mean only a slight increase in the feed rate and would probably do more good than harm.

A very definite advantage of hydraulic feed is shown in Fig. 13, i. e., the flexibility of the feed, which permits it to be varied during the cutting cycle, thus maintaining a uniform chip thickness, lessening the rubbing action, increasing cutter life, and giving more pieces per hour, which in the final analysis is the primary objective of using carbide-tipped tools. Fig. 15 shows a cast steel part milled with the setup shown in Fig. 13.

Elimination of skepticism as to the safety of very narrow carbide-tipped milling cutters, which evolved after a long period of development, has been efficacious in selling this new technique.

A case in point is demonstrated in Fig. 16, which shows a milling cutter designed for the operation of slitting a copper casting. On the first tryout, after setting the machine to the proper feed and speed and starting the cut, the chips accumulated so rapidly that they failed to clear the cut, stalling the cutter and crumbling it like so much paper. This fault was corrected and the operation is now paying good dividends. A by-product of this wreck was the fact that the new cutter has proved to be practically shatterproof as compared to high speed steels where the bodies are hard.

Conclusions

The foregoing is a brief description of the application of carbide-tipped cutters and tools in our plant. We have found that if basic fundamentals are carefully analyzed and the system of tool controls is adhered to, the problem of tool application can be solved.

Knurling of Socket Screws originated with "Unbrako" in 1934.

Eliminate
"fumbles"

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Reg. U.S. Pat. Off.

Knurled SOCKET HEAD CAP SCREWS

Those time-consuming, money-wasting "fumbles" . . . when a machinist's oily hands slip and slide as he attempts to pick up or screw-in a cap screw . . . are easily eliminated with the "Unbrako" **knurled** Socket Head Cap Screws. The knurls provide a "fumble-proof" grip, even for oily fingers, so the "Unbrako" can be screwed-in faster and farther, before it becomes necessary to use a more or less clumsy wrench. In sizes from No. 4 to 1½" . . . write for the free "Unbrako" Catalog.

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Use these TIME SAVERS to build Your Jigs and Fixtures

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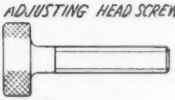
ADJUSTING HEAD SCREWS



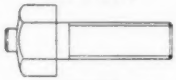
8 SIZES

ADJUSTING HALF NUTS

4 SIZES

"C" WASHERS

CLAMP RESTS

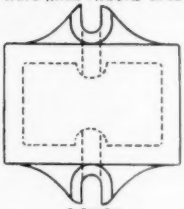


3 SIZES

FLANGE NUTS

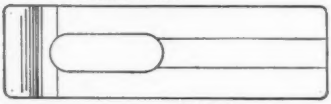
4 SIZES

GANG MILL FIXTURE BASES



3 SIZES

HEEL CLAMPS

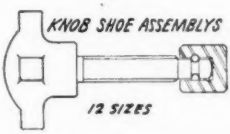


12 SIZES

GROUND THREAD STUDS

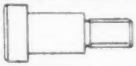
13 SIZES

KNOB SHOE ASSEMBLYS



12 SIZES

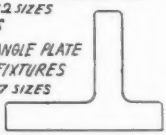
SOCKET HEAD SHOULDER SCREWS



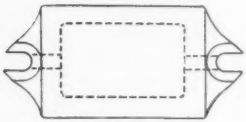
20 SIZES

T-ANGLE PLATE FIXTURES

7 SIZES

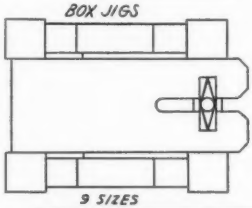


MILL FIXTURE BASES



4 SIZES

BOX JIGS



9 SIZES

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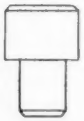
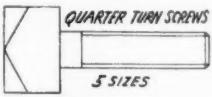
5 SIZES

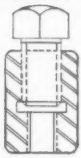


QUARTER TURN SCREWS



5 SIZES

STUD DRIVERS



4 SIZES

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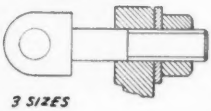

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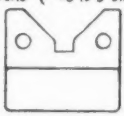
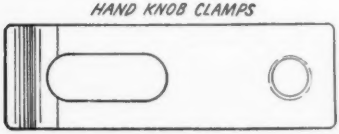


HAND KNOB CLAMPS



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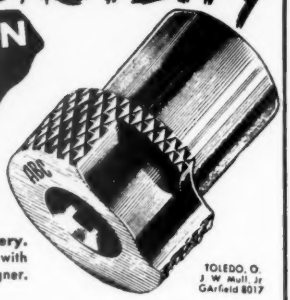

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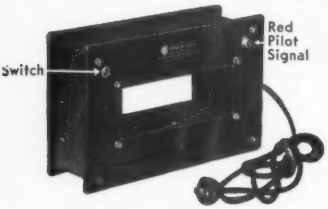

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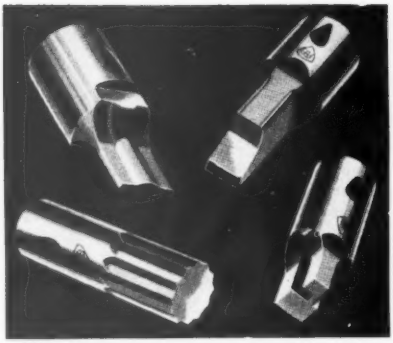

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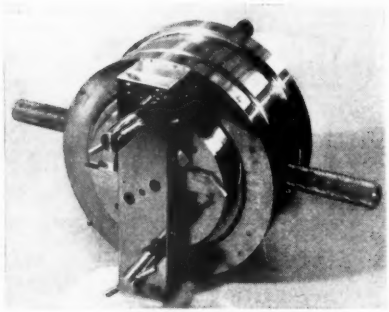

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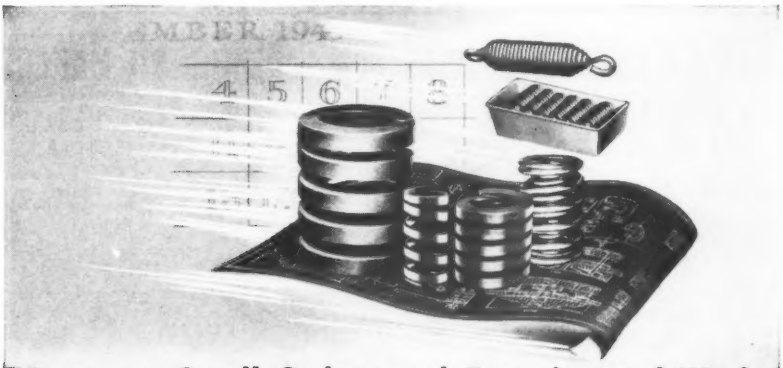

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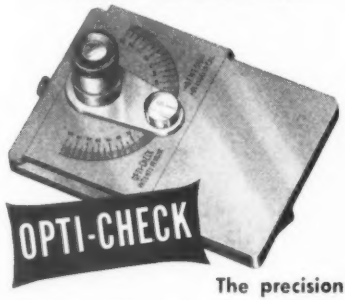

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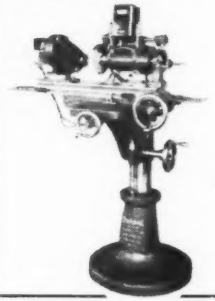

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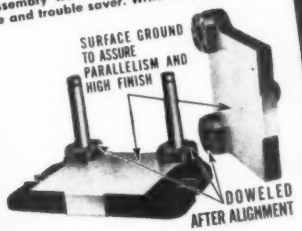

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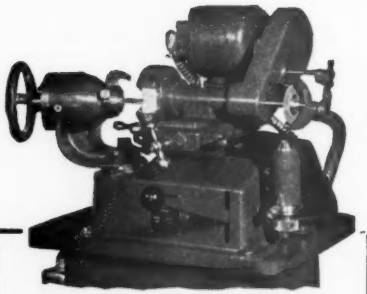

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This model has been engineered for applications where a small rugged tool can be used advantageously. Steel body for Safety. SPECIAL GREASE-SEALED BEARINGS, REQUIRING NO AUTOMATIC OR MANUAL LUBRICATION. Compound rotors develop an abundance of power. Extremely lightweight, 12 oz. Whole length 5⅜"; Length of body 3". Accommodates mounted grinding wheels, rotary files, etc., on ⅛" dia. shanks. Prompt deliveries.

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PREIS ELECTRO-MARKER

CLEAN—SAFE—ECONOMICAL
Marks Iron, Steel, Carbides

Has 10-tap rotary switch, for any degree of marking. Hand-piece is hollow, with ample heat insulation. Special alloy point is set at an angle and stands vertical to work when held in normal writing position. *Write for circular.*

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Square, Straight Tapping in HALF THE TIME

42 50 F.O.B. MINNEAPOLIS

The Dahlstrom Tap Guide practically eliminates tap breakage, and turns out uniform work. Just fasten it to a post or bench, slip a Tap Adaptor into the spindle, and turn the handle. Equipped with 7 Adaptors from 8/32 to ½" (taps not furnished). Ask your mill supply house, or order direct. Literature on request. Dahlstrom Mfg. Co., 422 South Sixth St., Minneapolis 15, Minn.

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LET US HELP YOU

We design and manufacture Dies, Tools, Fixtures, Special Machinery and 5 to 90 ton capacity Small Stampings. All new machinery — 1000 man-hours a week available.

Estimates submitted promptly from your prints.

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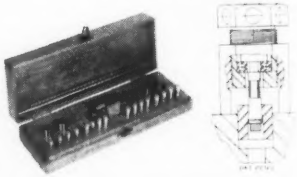

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These extractors have been engineered and developed to do a job in a manner not possible before.

In addition to pulling pierce die inserts, it may be used on ball bearings, sleeves, liners, etc., the merit of this tool has been proven by the many users in the field.

We solicit your extractor problems and assure prompt attention to inquiries.

BOLDUC SPECIALTIES CO.
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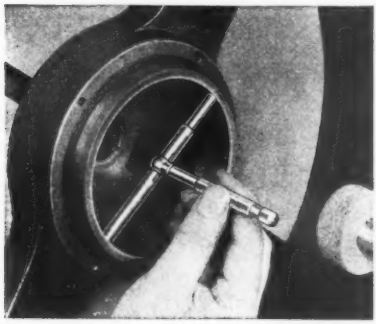
EXCLUSIVE! PLUNGERS QUICKLY CENTERED FOR PERFECT BALANCE



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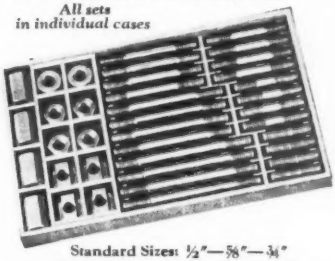
Saves Set-Up Time

Case hardened for long life; chrome plated for rust prevention; easy to keep clean.

All sets in individual cases



Standard Sizes: ½"—⅝"—¾"

4—3" Studs; 4—4" Studs; 4—5" Studs; 4—6" Studs; 4—7" Studs; 4—8" Studs; 4 Nuts; 4 Washers; 4 T-Slot Nuts; 4 Coupling Nuts

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Manufacturers of Tools, Gages and Their Accessories
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Burke motor driven milling machines Nos. 1, 2, 3, and 4 are specially suited for handling small, difficult work on a production basis.

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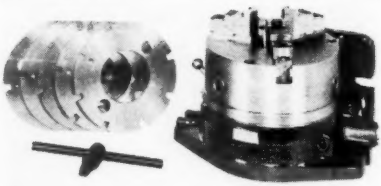

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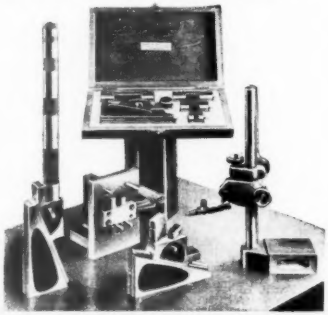
A PRECISION CHECKING TOOL

Parallel in all positions to .0001
Gauge is 1" thick, Standards 1" dia.
Over 16" high
Easy adjustment — Positive lock

Set this tool to your indicator reading, lock the adjusting nut, your reading remains the same. Write for further details.



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A MACHINE TOOL designed to give the fine finish and high degree of accuracy necessary in the finest gage grinding and tool and die making.

It is built with a sturdy ruggedness that maintains that fine accuracy for a long period of time . . . much longer than most similar tools are expected to last.

Such long lasting precision performance gives the inevitable result of greater economy.

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These efficient tool kits speed up your counterboring and spotfacing work, by putting a wide range of cutter and pilot combinations within easy reach. Seven sets from which to choose.

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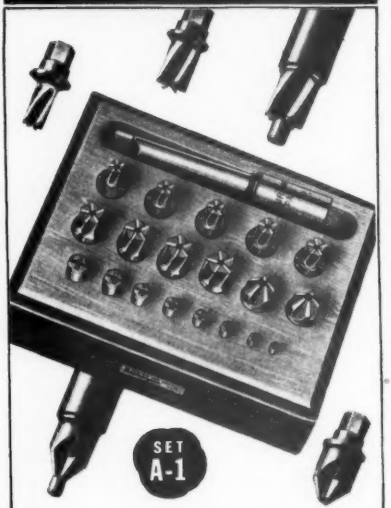

This set includes: one type A-1 holder; nine cutters from ¼" to ½"; eight pilots from 5/32" to ⅜"; two ½" countersinks, one 70° and one 82°, in hardwood box with hinged cover.

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BY ALL MEANS USE

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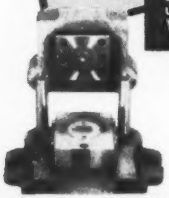

Once you invest in Hovis Master Dies to meet your requirements,

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Eliminate the cost of complete new dies. *Write for literature.*

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For quantity production, NEOR is unsurpassed for dies. Retains a keen edge much longer than carbon or high speed steels. NEOR hardening penetrates to the center of the tool and is non-deforming.

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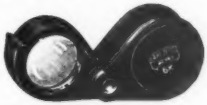

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HONES
(Sintered Steel Bonded)

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FS Diamond Hones are also recommended for shaping special contours on carbide form tools, where diamond grinding wheels do not suffice.

Hone is 6" long overall—diamond section being 1¼" x ½". For best results a 325-400 grit is recommended, and FS Diamond Hones are so stocked. Other grits from 100 to 600 also available.

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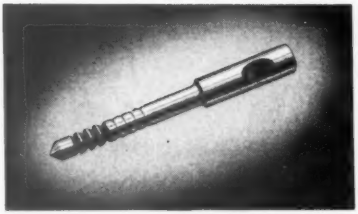
RECIPE FOR PRECISION



Start with high-speed Delloy steel. Machine it in the rough. Heat-treat according to the specifications for that particular steel. Grind the shank in a centerless grinder to a tolerance of plus or minus .00025". Place in a cylindrical grinder, grinding the sizing and burnishing diameters of the bit to a tolerance of plus 0", minus .0005". Result: a fine precision instrument, a product of Ace skill down to the last ten-thousandth of an inch.

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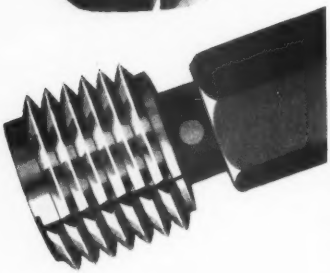

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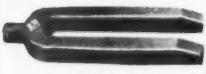

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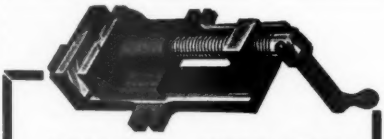

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This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	4	12½
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Do you need a vise of ANY type?

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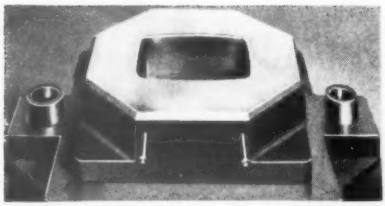

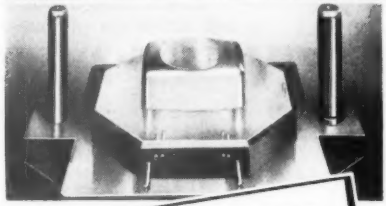

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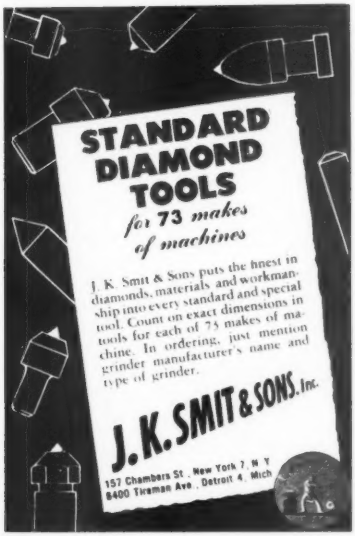
FOR DRAWING AND FORMING DIES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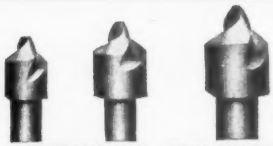

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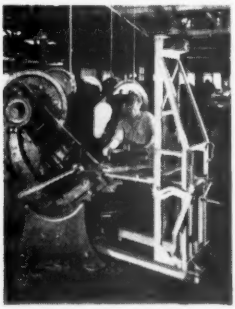

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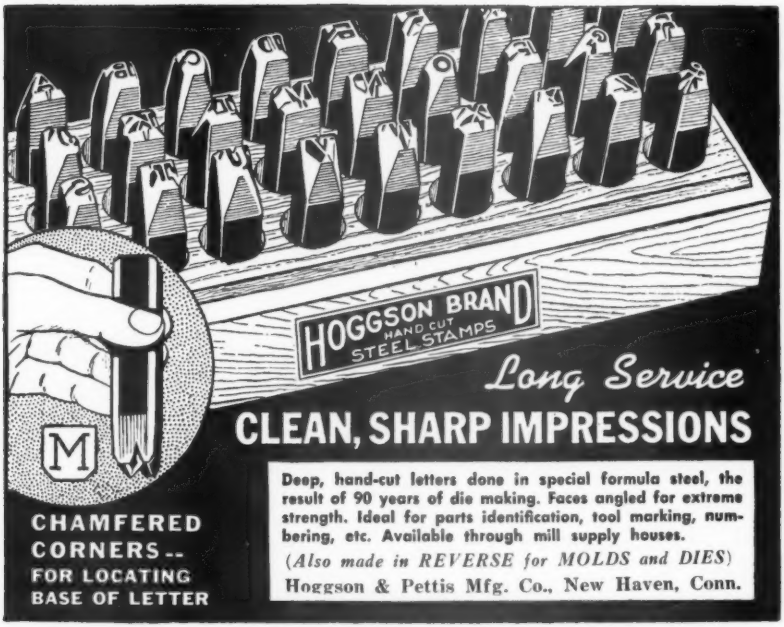

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Deep, hand-cut letters done in special formula steel, the result of 90 years of die making. Faces angled for extreme strength. Ideal for parts identification, tool marking, numbering, etc. Available through mill supply houses.

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20" long x 12" wide x 6½" deep.
16 ga., drag holes and handles both ends.

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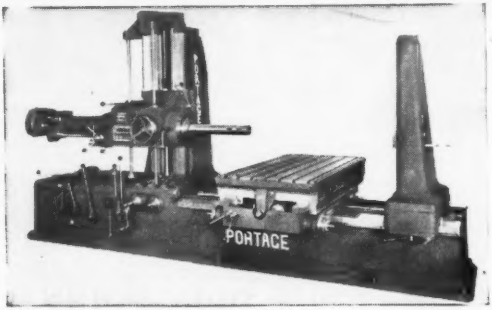

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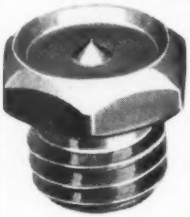

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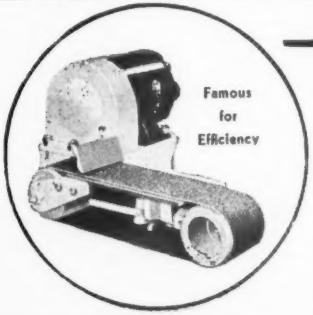

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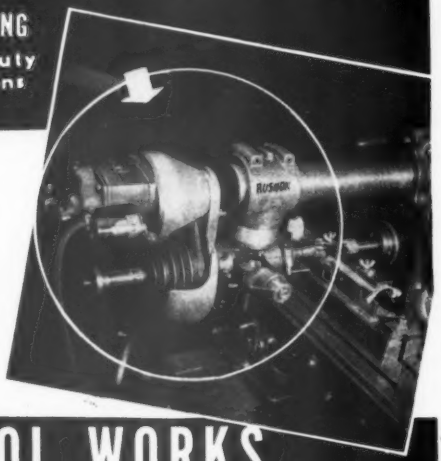

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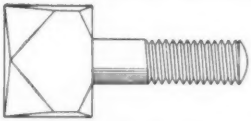

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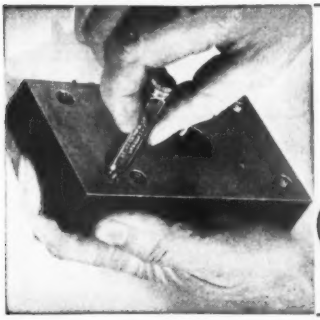

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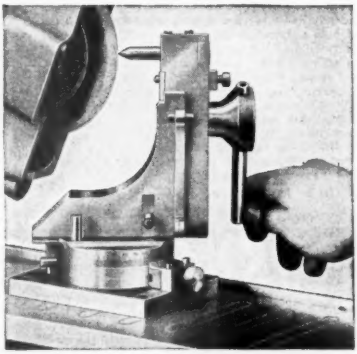

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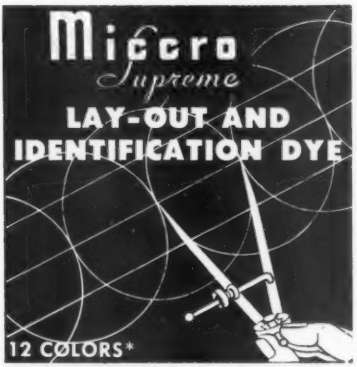

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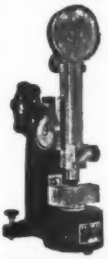

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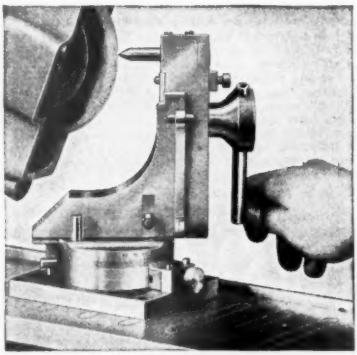

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Large range yet compact
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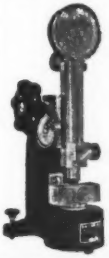

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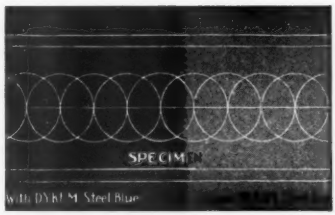

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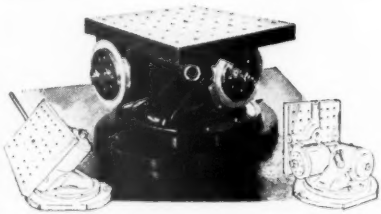

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Correction

In the half page advertisement of the Anton Machine Works, 52 Sands Street, Brooklyn, New York, which appeared in the May issue, page 137, the maximum variation in parallelism and straightness within length of the Anton Parallels was incorrectly given as .001, when it should have read .0001.

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HEAT TREAT SMALL PARTS

In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door—Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$146.00*
MH-4	10"W 6"H 18"L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

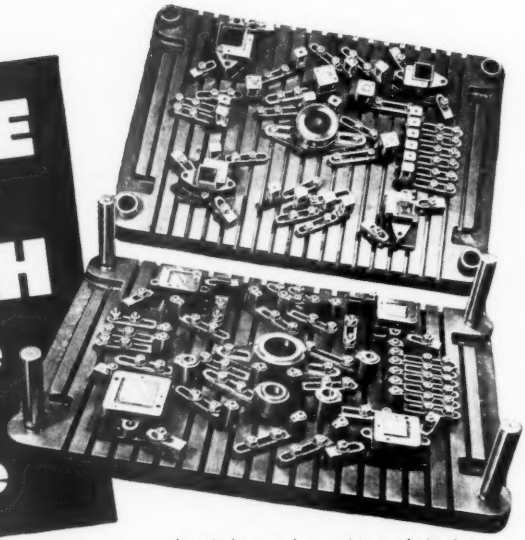
COOLEY ELECTRIC MANUFACTURING CORP.

32 South Shelby Street Indianapolis 7, Indiana

INDIANAPOLIS MACHINERY-EXPORT CORP.

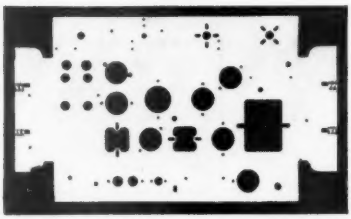
Export Manager, 44 Whitehall Street, New York, New York

PIERCE and NOTCH at the same time



A typical set-up for notching and piercing.

Pierced and notched with Whistler multi-use adjustable dies.



with

WHISTLER MULTI-USE Adjustable Dies

You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.

Whistler multi-use adjustable dies are available from stock...a day or two from your plant...in all standard sizes from 1/32" to 3" diameters...round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

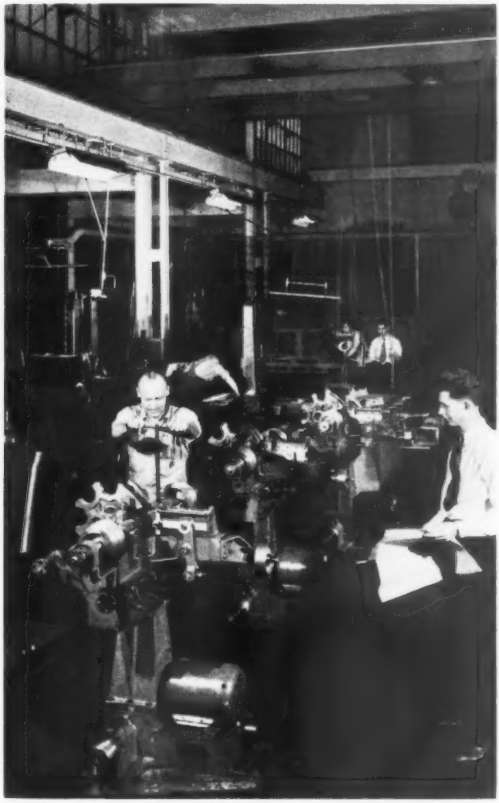
Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for...you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production...cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

PRECISION *Unlimited*



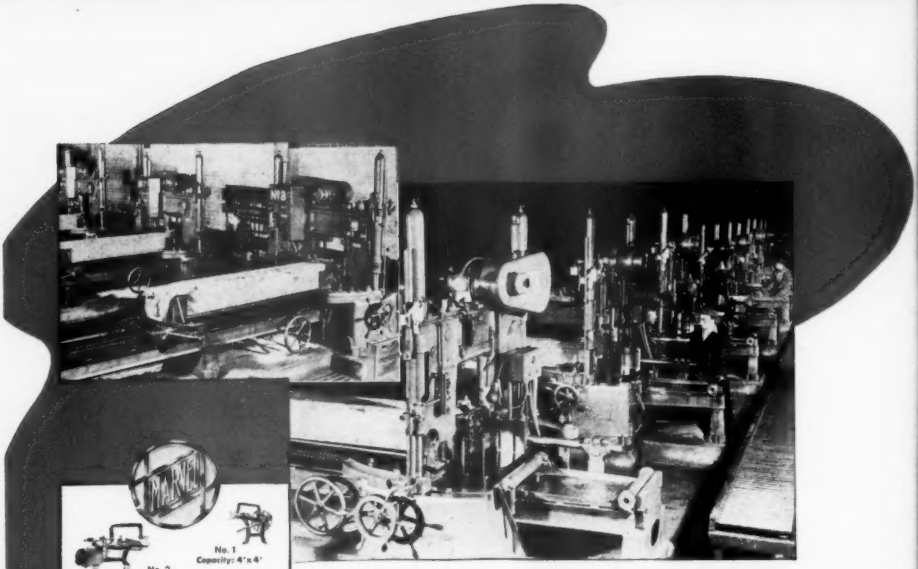
●The "Habit of Precision" at J. C. Ulmer is not confined to tools, gages, jigs and fixtures. Ulmer built special machines are precision *plus* for dependable, economical operation.

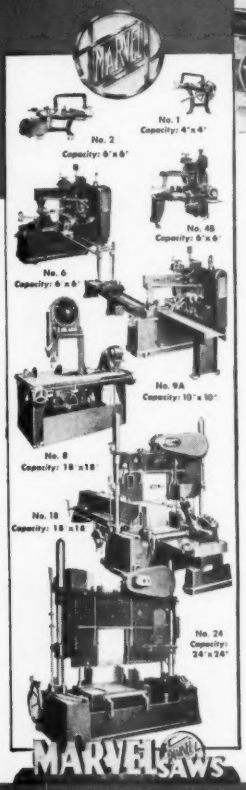
The J. C. Ulmer Company invites you to submit drawings, specifications or samples for detailed and accurate suggestions and estimates. There is no obligation, of course.

A part of the J. C. Ulmer erecting room. The largest of the cranes has a lifting capacity of 7½ tons. In the foreground are special machines under construction.

THE J. C. ULMER COMPANY
1791 East 38th Street
Cleveland 14, Ohio

The Habit of Precision
Since 1893





Part of the row of No. 18 MARVEL Giant Hydraulic Hack Saws used to crop and cut-off test slices for metallurgical tests for large billets of tough alloy steels.

MARVEL No. 18 Hydraulics 12 in a row

When a greatly expanded steel plant, near Canton, Ohio, faced the problem of cropping and cutting-off test samples from large alloy billets, in WARTIME quantities and at wartime speed, they checked the performance of all types of cutting-off equipment in all their other company plants, and selected MARVEL No. 18 Giant Hydraulic Hack Saws for this "tough" job.

Now this row of twelve MARVEL No. 18 Hydraulics shown above, operating continuously, 24 hours a day on tough alloy billets of from 14" to 16" cross section, handle this tremendous, heavy duty cutting-off job without a hitch and with a minimum of man hours—only four operators per shift.

When you have a cutting-off problem, your most logical first step is to check with your local MARVEL Sawing Engineer for recommendations of methods and equipment.

For quick reference see our section in Sweet's File—Mechanical Industries or write for catalog.

ARMSTRONG-BLUM MFG., CO.

"The Hack Saw People"

5700 West Bloomingdale Ave., Chicago 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., N.Y., 12